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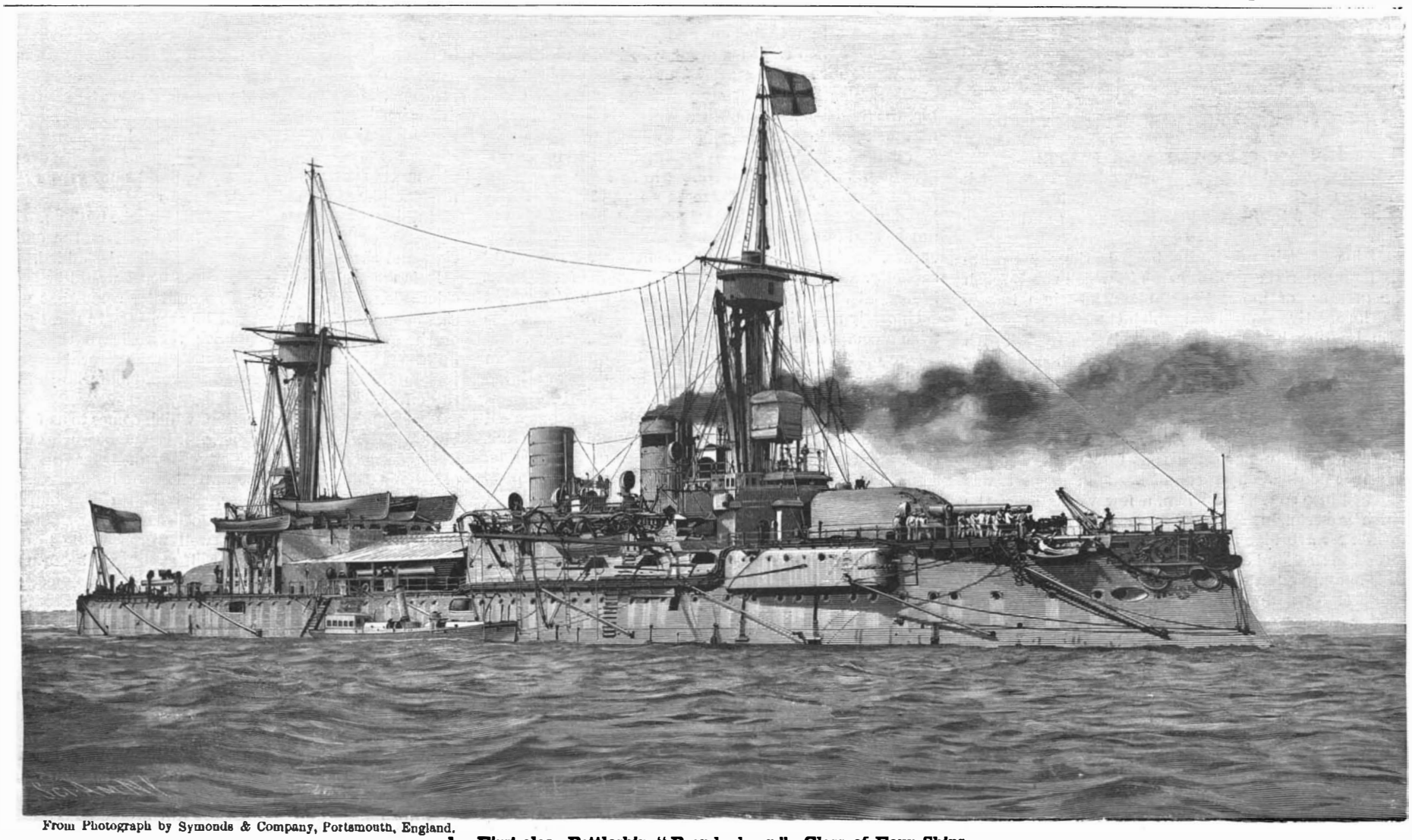
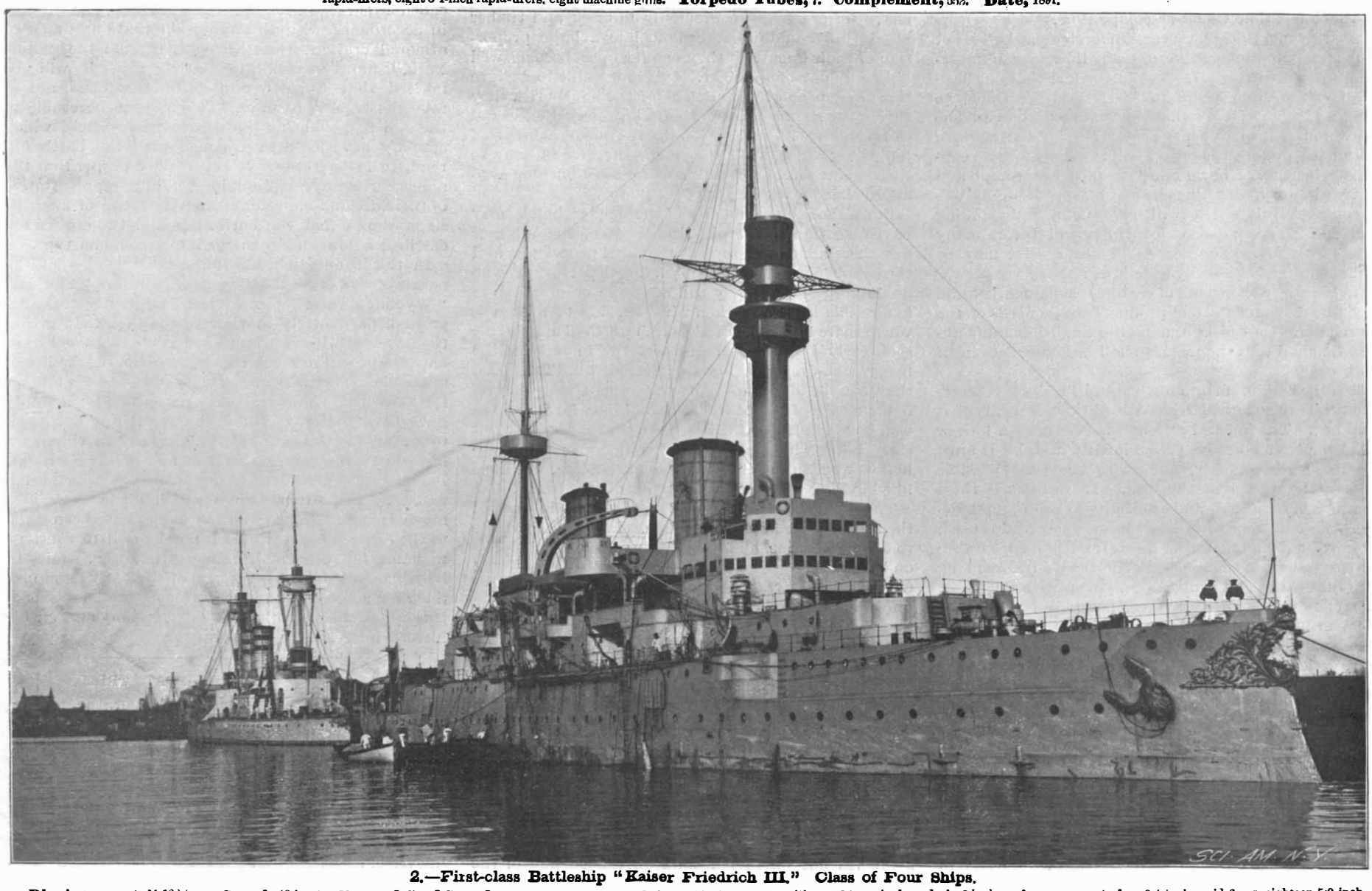


From Photograph by Symonds & Company, Portsmouth, England.

1.—First-class Battleship "Brandenburg." Class of Four Ships.

Displacement, 10,100 tons. **Speed,** 16·5 knots. **Normal Coal Supply,** 750 tons. **Armor:** Belt, 15¾ inches; gun positions, 11¾ inches; deck, 2½ inches. **Armament,** six 11-inch B. L. rifles, six 4·1-inch rapid-firers, eight 3·4-inch rapid-firers, eight machine guns. **Torpedo Tubes,** 7. **Complement,** 552. **Date,** 1891.



2.—First-class Battleship "Kaiser Friedrich III." Class of Four Ships.

Displacement, 11,130 tons. **Speed,** 18 knots. **Normal Coal Supply,** 650 tons. **Armor:** Belt, 11¾ inches; gun positions, 9¾ to 6 inches; deck, 3 inches. **Armament,** four 9·4-inch rapid-firers, eighteen 5·9-inch rapid-firers, twelve 3·3-inch apid-firers, twelve 1·4-inch rapid-firers, eight machine guns. **Torpedo Tubes,** 6 (5 submerged). **Complement,** 655. **Date,** 1896.

NAVIES OF THE WORLD—V. GERMANY.—[See page 250.]

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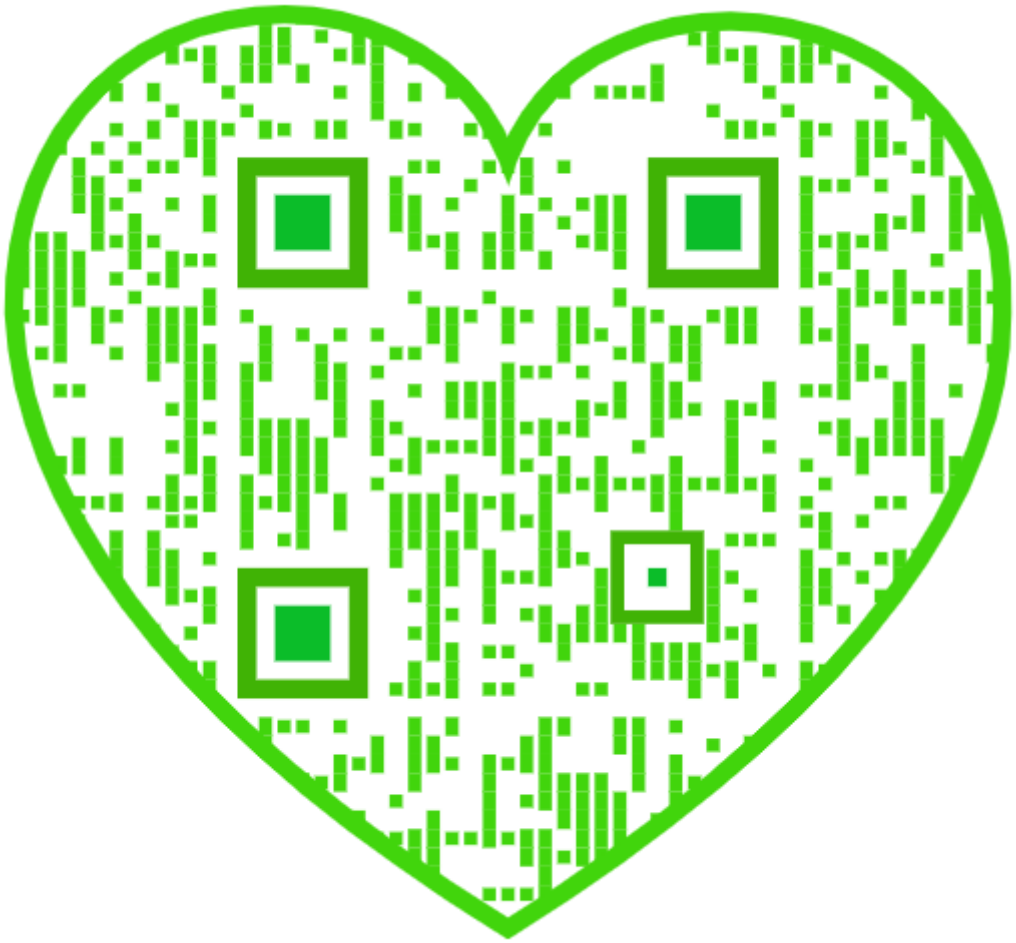

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NEW YORK, SATURDAY, APRIL 22, 1899.

THE THIN END OF THE WEDGE.

Englishmen and Americans alike have been quick to realize the significance of the recent placing of orders in this country by England for locomotives and bridge work.

Outside of their splendid shipyards, there are probably no industrial establishments in which the English take greater or more justifiable pride than in the great locomotive shops from which the railroad system of England has been hitherto exclusively supplied with its motive power. To have first one and then another of its great trunk roads place an order for a score of first-class locomotives with a foreign firm has, therefore, produced a degree of surprise and misgiving which no subsequent explanations by the directors have been able to allay. The suspicion that foreign invasion of exclusive markets had commenced in earnest was deepened into conviction when, a few weeks later, the British government awarded to an American firm the contract for a bridge to be built on the line of the new railroad in the Soudan.

It is not enough to say that the sending of these orders abroad was due to the fact that English firms are crowded with work, some of which represents long-standing orders that were delayed by the great engineering strike, the rest being due to the remarkable era of prosperity in that country. This may have been the occasion, but it is not the cause. The cause lies deeper than any accidental shortage of locomotives on an English road or the military exigencies of the Soudan campaign. These may have hastened the insertion of the thin end of the wedge of competition, but they are not to be mistaken for the power which day by day will drive it home. The strength of American competition lies in the quality and low cost of our finished product, and in our ability and willingness to adapt it to the needs of the buyer, and to deliver it to him in so much less time than our competitors.

At the same time our success in foreign markets is not due merely to the fact that in many lines we can undersell our competitors. It was not the fact that our locomotives are from $2,000 to $3,000 cheaper than the English locomotives or that the Soudan bridge could be delivered at so many cents a pound less by an American firm that brought the orders here. We won those contracts because of our ability to promise prompt and early delivery, and this element of speed is only one among several which will give us a commanding position in every market of the world before many years pass by. The secrets of our success may be summed up categorically as follows:

1. We study the wants of each particular market and try to accommodate our products to the needs of the purchaser. On the other hand the English manufacturers demand that the market shall accommodate itself to the goods.

2. The design, manufacture, and finish of our commodities are governed by considerations of utility first and last. The finished article, whether it be a lock or a locomotive, must be pre-eminently useful. It must do its work quickly, and with the least possible care and expense to the user. If we secure these features of handiness and durability in the highest degree, we care very little how cheap a material is used, or how small an amount of finish for mere appearance sake is put upon the finished article. We realized long ago that cheap cost is not synonymous with weakness, nor mere weight with strength, nor polish with practical utility. We substitute wood for iron, cast iron for steel, and steel for the costly alloys when we are once satisfied that the cheaper material will serve the purpose equally well.

3. Capital and labor in America are both agreed that there is mutual profit in the substitution of the machine for the man wherever it is possible. Automatic and semi-automatic machinery cheapens the product, increases the demand, and so gives employment to five men for every one that it displaces. In England the operative, misled by the pernicious teachings of the trades unions, believes that the introduction of the labor-saving machine means the extinction of the mechanic. The result is that, while his American brother gets all he can, the English operative gets the least he can, out of the automatic machine.

If we were asked to name the cause which above all others is contributing to our success, we would point to the foregoing.

4. Our manufacturers realize the important economies which result from thoroughly systematized management. The clerical force, the draughting offices, and the shops are organized with a careful attention to detail, and are run in many cases with a strictness of discipline which is military in its order and method, and more than military in its accomplished results. The work is highly specialized, and its progress through the shops from the raw material to the finished product is so arranged as to avoid delay and enable it to pass from bench to bench and from department to department with the least amount of rehandling.

5. While our manufacturers aim to meet the demands of particular localities, they endeavor, as far as possible, to standardize their work, with a view to building for stock and keeping a surplus on hand to meet a sudden demand. We have carried this practice into fields in which our European competitors have never attempted to apply it. There is no valid reason why locomotives and (in the smaller sizes) bridges should not be sold out of stock, as well as lathes, reaping machines, or bicycles. They vary in size, shape, and capacity, and in proportion as the trade of our great industrial establishments extends, the risk of keeping such costly material in stock is lessened, while its value from a competitive point of view is immeasurable.

One of the English firms whose bid on the Soudan bridge was rejected on the ground of delay, declared that only a bridge-building firm that kept bridges in stock could guarantee delivery in the time proposed by the successful American firm. While this is not true, our excellent system of building to standard designs and with standard shapes gives us an unquestionable advantage in competitive bidding.

The performance of these American locomotives on the Midland and Great Northern railways will be watched with keen interest by the English master mechanics, or locomotive superintendents, as they are called over there. If they are only approximately as economical in fuel and durable under hard service as English locomotives of equal hauling power, their cheap cost and the rapidity with which they can be delivered will either make them the pioneers of many more to follow, or produce a radical change in the appearance and cost of the home-made English locomotives.

ECHOES OF THE WINDSOR HOTEL FIRE.

It is characteristic of the rush and ready forgetfulness of the times that the horrors of the Windsor Hotel fire should already have ceased to occupy the public mind. There are three or four thousand guests in similar fire traps (there are many of them) in this city, who are living contentedly in brick and timber hotels that would probably immolate a large proportion of their inmates if they should once become well ablaze by day or by night. It is impossible to believe that these people are conscious of the hourly risk they run, or the simplest instincts of self-preservation would cause an early emigration to the modern fireproof buildings, which, while they might not live fully up to their name, would at least be so far slow-burning as to afford time for the escape of the guests.

But although the inmates of these older hotels may have forgotten the awful object-lesson of the Windsor fire, there are others, such as the hotel proprietors and the members of the fire and building departments, who do not forget, and surely will not be so criminal as to ignore this latest warning. If "the life of a man is worth more than that of a sheep," we shall surely see some early steps taken to protect the inmates of the many non-fireproof hotels referred to. The least that can be done is to provide some speedy and reliable means of escape from the building, for it may as well be taken for granted at once that a six or eight story hotel with hollow wooden floors opening into hollow wooden partitions, when once ablaze, will burn like kindling wood or a Fourth of July tar barrel.

The late fire has shown once more the inadequacy of the stereotyped means of escape. It takes an athlete to descend a rope, and the aged and sick are helpless on balconies and fire escapes; internal stairways and elevator shafts are so many great flues impassable for smoke, if not for flame; and smoke and fire belching from outside windows frequently render the ordinary outside fire escape impassable. It is probable that more victims are overcome by smoke than by flames. It is the all-pervading smoke that so quickly renders useless the various means of escape both within and without the building.

What is needed is some independent stairway or elevator shaft, external to the building, and having no direct connection with the building through which fire and smoke can enter. This emergency shaft could be built either within or outside of the main walls of the building, provided that the openings at the different floors led out on to balconies on the outside of the building and there was from cellar to roof absolutely no direct opening from the building to the shaft. If this shaft were constructed of fireproof brick and with hollow walls, the elevators and stairways within it could be used even while the interior of the building was a seething furnace. At each floor there should be a door through the side walls of the building, if the shaft were on the inside, or through the wall of the shaft remote from the building, if it were on the outside, each door leading onto a balcony communicating with each of the rooms or passageways on that side of the house. In the case of new buildings, the designs should be so drawn that the walls in the immediate neighborhood of the emergency shaft should be windowless. At the ground floor a fireproof passageway should communicate directly with the street.

Now, with regard to the older fire-trap hotels existing in this and other cities, it is evident that these fire escape shafts could now be built against the rear walls in positions where they would not mar the architectural appearance of the buildings. Two such additions to the Windsor Hotel, with connecting balconies on three sides at every floor, would probably have enabled every victim that was shut out by fire and smoke from the interior elevators and stairways to escape. There is certainly every reason why shafts should be built against the rear walls of every important hotel of the older class and the necessary connecting balconies added.

It is true the inconvenience and cost would be considerable, and the balconies would be somewhat unsightly—though it would not be necessary to use them on the main front—but we have yet to learn that the buildings in question have so much architectural beauty that an iron balcony more or less would materially alter the effect.

We commend this suggestion, which comes to us from Mr. C. Baillairge, a civil engineer of Quebec, who has devoted many years to the advocacy of better means of escape from fire, to the notice of the building and fire departments of this city. If "the life of a man is worth more than that of a sheep"—which many people seem to doubt—it is surely well worth while to enforce the erection of this, or, if such can be found, some better way of escape from fire, in connection with the older hotels with which our large cities abound.

NAMING THE NEW WARSHIPS.

The warships authorized by the recent naval appropriation bill have been named by the Secretary of the Navy as follows: The three battleships, which are to be of 13,500 tons displacement and 18½ knots speed, are to be known as the "Pennsylvania," the "New Jersey" and the "Georgia;" the 12,000-ton cruisers will bear the names of "West Virginia," "Nebraska," and "California," while the six 3,000-ton protected cruisers will be known as the "Denver," "Des Moines," "Chattanooga," "Galveston," "Tacoma," and "Cleveland."

It is provided by law that the battleships shall be called after States, and the cruisers after towns. It was in accordance with this provision that our first two armored cruisers, the "Brooklyn" and the "New York," were named after cities; but it will be noticed that the new cruisers of this class are to take the names of States. This is more agreeable to the size and fighting power of these vessels, which actually have more in common with the battleship than with the cruiser. It is certainly proper that the names carried by our warships should be representative of their size and importance, and the trend of later designs shows that the battleship and the cruiser are destined before long to merge into a common type.

In this connection we think the selection of the names of States for the three little monitors "Florida," "Wyoming," and "Connecticut" is greatly to be regretted, particularly in view of the fact that giving the names of States to armored cruisers as well as to battleships will so much the sooner exhaust the list of available names, of which twenty-one out of a total of forty-five have already been appropriated. It would have been better, we think, to have named our monitors after famous admirals, particularly as there is a historical fitness in giving the names of Farragut, Porter, and others of their day to a type which originated in the stirring times which made these men famous; but inasmuch as these names have been given to the torpedo boats, would it not be well to continue to name this class after famous Indian chieftains or tribes, as was done in the case of the early monitors? Such names as Miantonomoh, Monadnock, and Canonicus appeal to us both for their euphony and strong historic interest.

A RECORD TORPEDO BOAT TRIAL.

The builders of the new cup challenger, the "Shamrock," have just completed a torpedo boat which has broken all records for an official trial trip by making a speed of 33 knots an hour. The "Albatros" is one of five sister vessels completing for the British government, whose contract speed is set down at 32 knots. She is of 360 tons displacement and her engines are designed to develop 7,500 horse power. In our own navy the vessel that most approximates to her is the torpedo boat "Stringham," of 340 tons displacement, 7,200 horse power, and an estimated speed of 30 knots. Thirty-three knots, while it is the highest speed attained at

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an official trial, is not the highest speed ever attained, the "Turbinia" having steamed 35 knots, and the "Hai Lung," a torpedo boat built by Schichau for the Chinese government, 35·2 knots an hour in private trials, the last named standing as the fastest speed ever made by any type of vessel.

LIQUID AIR AS A NEW SOURCE OF POWER—ANOTHER ENGINEERING FALLACY.

BY PRESIDENT HENRY MORTON, PH.D., LL.D., SC.D.

During 1894-95 the present writer prepared two articles under the title of "Engineering Fallacies," which were published in the Stevens Institute Indicator, vol. xi., pp. 273-294, and vol. xii., p. 125.

Since that time, though several new forms of what might be termed in a general way "Perpetual Motion Schemes" have appeared, none of them has seemed of sufficient importance to warrant any special notice, but in the March number of McClure's Magazine there is published an article entitled "Liquid Air—a new substance that promises to do the work of coal and ice and gunpowder, at next to no cost," which is so eminently calculated to mislead the general reader and even to become the basis of financial frauds, like that of the Keely Motor, that it would seem a duty to draw attention to the fundamental errors in scientific principles and in statement of facts which this article contains.

This McClure article may be fairly considered as made up of two prominent elements or parts, one of which is the statement of certain things as facts which, as I shall presently show, cannot possibly exist and are inconsistent with other facts stated in the same article and known from other sources to exist as so stated; while the other main element consists of rather vague statements concerning general principles which, though in a general sense true, yet as here used are calculated to cover up or befog the too obvious inconsistencies of the statements of facts with the established principles of science.

As an example of the first element, we find on page 400 as follows: "I have actually made about ten gallons of liquid air in my liquefier by the use of three gallons in my engine." This I shall presently show is simply impossible and inconsistent with data given elsewhere in this article and known to be substantially correct.

A sample of the other element is found on page 399, in the following:

"That is perpetual motion, you object. 'No,' says Mr. Tripler sharply; 'no perpetual motion about it. The heat of the atmosphere is boiling the liquid air in my engine and producing power exactly as the heat of coal boils water and drives off steam. I simply use another form of heat. I get my power from the heat of the sun; so does every other producer of power.'"

This, while true as a general statement of what might be done on an impractical scale, is not correct as here used to imply that in his experiments Mr. Tripler actually derives or can derive any adequate amount of energy from the heat of the atmosphere or in that sense directly from the sun. This I shall show later, but will first take up the statement that three gallons of liquid air have supplied or can supply the power to liquefy ten gallons.

On pages 402 and 403 of the McClure article we are told that Mr. Tripler uses to make his liquid air a steam engine of 50 horse power and that with this he can make liquid air at the rate of 50 gallons a day. This I know, from other sources, is substantially correct, and means that each horse power in a day (say 10 hours) makes 1 gallon of liquid air. In other words, 1 gallon for 10 horse power hours.

It is again stated in this article on page 405 that a cubic foot of liquid air contains 800 cubic feet of air at ordinary atmospheric temperature and pressure, or, in other words, any volume of liquid air, if adequately heated, will expand 800 times in reaching atmospheric temperature and pressure. This also is substantially correct.

We may remark in passing that this is nothing wonderful; for water, when expanded into steam at atmospheric pressure, increases about 1,700 times in volume, or more than twice as much as liquid air.

Now if we apply to the above data the well known and universally accepted formula for the maximum work done by air when expanded at constant temperature,

$$W = p_2 v_2 \text{ hyp log} \frac{v_2}{v_1}$$

we find that a pound of liquid air in expanding 800 times would develop about 190,000 foot-pounds of work. As a gallon of liquid air weighs about 8 pounds, this would give eight times as many foot-pounds, or 1,520,000. If this work were accomplished in an hour, it would represent almost exactly three-fourths of a horse power, because one horse power means 1,980,000 foot-pounds of work per hour, and 1,520,000 is only a trifle over three-fourths of this.

From the above it follows as a matter of absolute certainty that the maximum power which liquid air could develop in an ideally perfect engine without any loss from friction or other cause would be three-fourths of a horse power for an hour for each gallon of liquid air expended.

We have seen, however, that with his 50 horse power plant, which on account of its size should operate with considerable efficiency, Mr. Tripler makes only 1 gallon of liquid air with 10 horse power hours. In other words, he requires to make a gallon of liquid air twelve times as much power as a gallon of liquid air could possibly develop in an ideally perfect engine.

In face of this, how supremely absurd is the statement that with a little engine such as the pictures and descriptions in the McClure article show, lacking all conditions for efficient working, Mr. Tripler can make 10 gallons of liquid air by the use of three.

Turning next to the statement about using the heat of the atmosphere to develop mechanical energy or work, let us put this to the test of a quantitative example.

Assume the temperature of Mr. Tripler's laboratory to be 70° F. and that he has an abundant supply of water at 50° F. These will be of necessity the limits of work he can get out of the atmosphere, because any lower temperature is only secured by doing work and so expending energy which will be at least equal to the power obtainable from the use of such lower temperature. All the work that can be obtained for nothing is that which nature will freely give in the warm air and cool water, supposing both to be supplied freely without charge.

The 20° F. which we may assume as being possibly taken out of the air by the cool water will represent the maximum gift of nature in this shape of "power costing nothing." Now, 42 British thermal units or pounds of water changed 1° F. per minute will represent one horse power, and as the specific heat of air is about one-quarter that of water, we should need four times as many pounds of air to produce the same effect. This would call for 168 pounds of air changed 1° F. If, however, the air is changed 20° F. in place of 1° F., we need but $\frac{1}{20}$ or 8·4 pounds of air parting with 20° F. each minute, to give us 1 horse power at 70° F. For "round numbers," let us say 8 pounds. Now, a pound of air has a volume of about 13·3 cubic feet. Call this also, for "round numbers," 13 cubic feet, then 8 pounds of air would be about 104 cubic feet, and this volume of air would have to part with its 20° F. heat each minute to the apparatus, in order to develop one horse power. For a 50 horse power engine fifty times as much air would be required, or 5,200 cubic feet each minute; this would be the contents of a room 26 × 20 feet on the floor and 10 feet high, which would have to be drawn through the apparatus each minute in such a way as to completely yield its 20° F. between 70° F. and 50° F. What sort of a boiler or heat-absorbing apparatus can we imagine which would absorb from air at 70° F., 20° F. of its temperature while the said air was passing through it at the rate of 5,200 cubic feet a minute?

It would surely need to be "as big as a house," to use a familiar phrase.

This also, be it remembered, makes no allowance for loss by friction, eddy currents, and the like, which would be enormous, nor for the power to put this air in motion.

Obviously, such a machine would be simply huge in size, and, indeed, the friction involved in it would probably use up a large part of the power it could develop.

Suppose, however, that it could be built and operated in place of Mr. Tripler's 50 horse power steam plant. Its entire output would be 50 gallons of liquid air a day, and this, as we have seen, could only develop in an ideally perfect engine ¾ horse power for an hour for each gallon or 3¾ horse power for a day of 10 hours.

This does not look as if heat obtained from the atmosphere and operating an engine by aid of liquid air is likely to become a dangerous rival to the coal mine.

On page 402 of the McClure article it is stated that Mr. Tripler makes his liquid air at a cost of twenty cents a gallon.

We have shown above that the maximum power obtainable from this liquid air, by heating it to ordinary atmospheric temperature, is ¾ of a horse power hour. This, at twenty cents, would be vastly more expensive than power derived from an ordinary steam engine, whose cost ranges from less than one cent per horse power hour under the best conditions to three or four cents, where a profit is included, or the conditions are less favorable.

The really difficult thing to explain in connection with this McClure article on Mr. Tripler and his liquid air, is how those concerned in its publication (being as I do not doubt honest men) can be deceived or have so deceived themselves as to make and repeat such obviously impossible statements.

In this connection, however, I will make a suggestion founded on experience.

Some years ago I was called upon to examine an engine operated with liquid carbonic acid, which was said to have ten times the efficiency of an ordinary steam engine.

I of course told the applicant that such a thing was physically impossible and did not deserve investigation, but, finding that a number of substantial people had been so impressed by what had been shown them that they would not be satisfied without an investigation, I consented to make one. This proved an easy piece of work. I found that the promoters and others were under the impression that a horse power was measured by the raising of 33,000 pounds one foot high irrespective of time, and in their demonstrations were contented with showing that their engine did this amount of work in ten minutes. As, however, a horse power involves the raising of 33,000 pounds one foot high in one minute, it was obvious that the power shown by the carbonic acid engine was $\frac{1}{10}$ of a horse power and not one horse power, as those exhibiting the engine claimed.

This, of course, explained the situation. An engine developing $\frac{1}{10}$ of a horse power might easily require only $\frac{1}{10}$ as much fuel as an ordinary steam engine developing 1 horse power, without violating any of the established laws bearing on this subject. The curious thing was that such people as were concerned in this matter should have been misled on such a simple and elementary subject; but if they were, as I personally know, so misled, why may not Mr. Tripler and his friends be in a similar case?

I could give from my own personal experience many like examples, but have said enough for the present to make it evident that what is claimed in this McClure article as a new source of "power which costs nothing" is not founded on fact, but is probably the result of some oversight in observation or calculation not inconsistent with honesty of intention.

THE NEW SATELLITE OF SATURN.

Prof. William H. Pickering, as the discoverer of the new satellite of Saturn, suggests that the name "Phœbe," a sister of Saturn, be given to the new satellite. Three of the satellites, Tethys, Dione, and Rhea, have already been named for Saturn's sisters, and two, Hyperion and Iapetus, for his brothers. The direction of the motion, which is toward Saturn, shows that the apparent orbit is a very elongated ellipse and that it lies nearly in the plane of the ecliptic. Prof. Asaph Hall has pointed out that this is to be expected in a body so distant from Saturn. The attraction of the latter only slightly exceeds that of the sun. Hyperion appears as a conspicuous object on the plates which have been taken by direction of Harvard College Observatory, and the new satellite appears about a magnitude and a half fainter on each. As seen from Saturn it would appear as a faint star of about the sixth magnitude. Assuming that its reflecting power is the same as that of Titan, its diameter may be about 200 miles. It will, therefore, be noticed that while it is probably the faintest body yet found in the solar system, it is also the latest discovered since the inner satellites of Uranus in 1851. Prof. James E. Keeler, director of the Lick Observatory, says: "Considering the extreme faintness of the satellite and its great distance from Saturn, it is not surprising that this discovery was not made by visual observation. With a great telescope directed to Saturn the satellites would be far beyond the limits of the field."

The last discovery of a satellite of Saturn was made in September, 1848, by Prof. W. C. Bond, then director of Harvard College Observatory, and his son, Prof. George P. Bond. The satellite Hyperion was seen by his son September 16 and 18, but its true character was first recognized on December 19, when its position was measured by both father and son. Soon after it was discovered independently by Laselle at Liverpool.

PROGRESS OF THE ZOOLOGICAL PARK.

Two new buildings are rapidly nearing completion in the grounds of the new Zoological Park. These are the reptile house and the winter house for birds. The Park Department is also constructing walks and roads and is laying sewer and water pipes. Much work has also been accomplished upon the various outdoor animal dens. In a hollow in the park is a body of water which will be utilized for aquatic rodents. The beaver pond is also ready, while up on the elevated portions among the rocks work on the bear dens is well under way. Owing to the configuration of the park, many of the outdoor inclosures need but little changing beyond fencing in. The work on the buffalo house is rapidly progressing.

THE English Society for Checking the Abuse of Public Advertising, or "Scapa" as it is called for short, has approached the Chancellor of the Exchequer with the suggestion that exposed advertisements should be taxed, contending that a moderate impost would tend to greatly reduce the volume of displayed advertisements without causing any real loss or hindrance to legitimate forms of advertising. The Chancellor replied that he could only regard the matter from the point of view for revenue, and he could not see on what ground the tax on advertisements could be defended unless newspaper advertisements were included.

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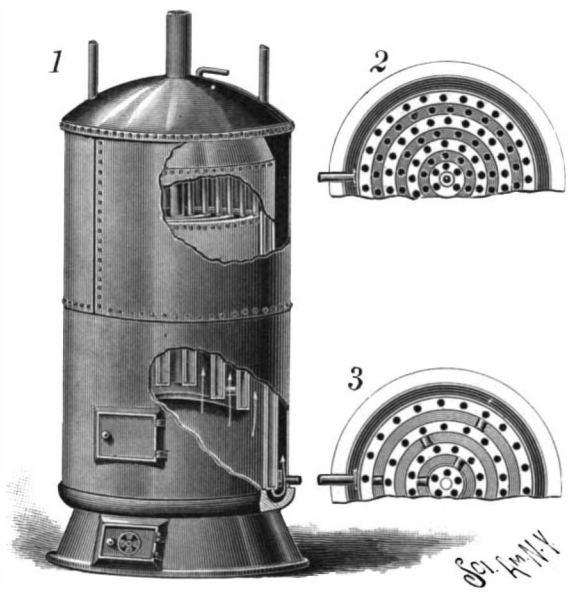
A BOILER OF NOVEL CONSTRUCTION.

In a new boiler invented by Jacob F. Klugh, of Highspire, Penn., ingenious means have been provided for securing a rapid circulation of the water, a large heating surface, and a utilization of the fuel to the utmost profit.

Fig. 1 illustrates the boiler in perspective, parts being broken away to show the interior construction. Fig. 2 is a sectional plan view taken through the water and steam compartment. Fig. 3 is also a sectional plan



A BOILER OF NOVEL CONSTRUCTION.

view, but taken through the lower portion of the water and heating sections.

The boiler comprises a series of concentric, circular water-sections, closed at the bottom, but opening at the top into the water and steam compartment. The outermost of these sections extends below the others, and is seated in a circular groove in the base of the boiler. By reason of this arrangement, annular heating spaces are formed between adjacent water-sections; and a central flue is formed by the innermost water section, which flue extends up through the water or steam compartment and the crown-sheet to open into a heat and smoke box arranged above the crown-sheet. The lower, closed ends of the water-sections are branch-connected, so as to enable the water to circulate through the boiler. Through the water-sections and the water or steam compartment pipes extend; through the crown-sheet similar pipes extend to connect the heating spaces with the heat and smoke box; and in the outermost water-section are pipes opening at their lower ends into the grooves of the base. A draft and heating chamber surrounds the outermost water section and opens into a dome. Between the heat and smoke-box and the dome a valved connection is provided which enables the two chambers to be directly connected.

In a boiler thus constructed the heat is required to penetrate only a thin sheet or body of water, thereby very rapidly converting the water into steam with a minimum amount of heat.

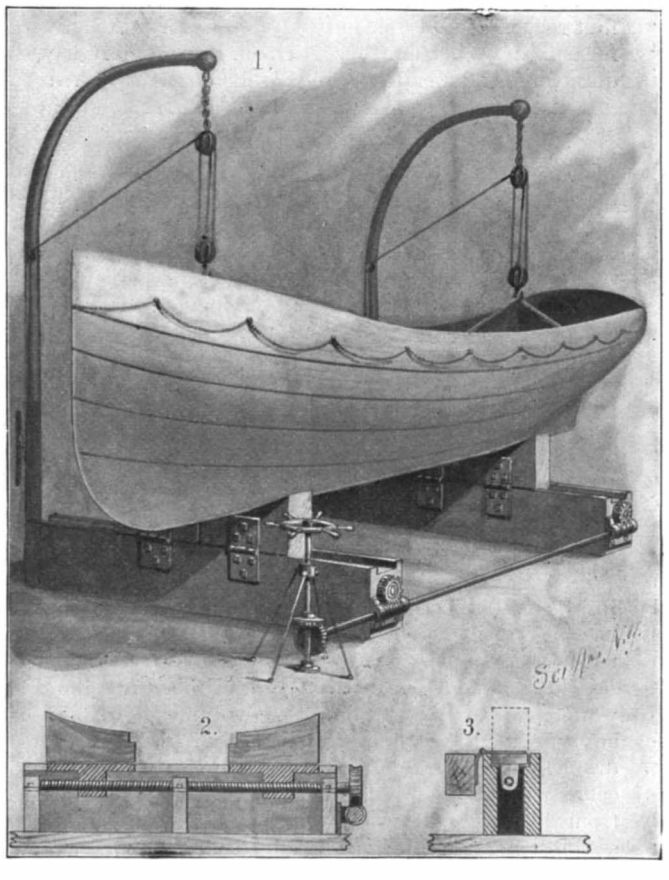
A SHIP'S BOAT SUPPORTING AND LAUNCHING DEVICE.

A ship's boat, in order to be launched by the ordinary method, must first be raised before being swung out and lowered. In cases of emergency this operation could be properly performed only by a ship's crew. An invention patented by Henry J. Matson, of the steamship "La Touraine," Compagnie Générale Transatlantique, Pier 42 North River, New York city, provides a simple device whereby the launching of a boat can be readily performed by the passengers without the assistance of the crew.

Of the accompanying illustrations, Fig. 1 is a perspective view of the device showing a boat placed thereon. Fig. 2 is a longitudinal section through a supporting-block used in connection with the device. Fig. 3 is a cross-section showing the supporting-block in two positions.

To the deck of the ship, beneath each boat, are secured two cross-beams. Upon guideways in these beams, plates slide to which the blocks which support the boat are hinged, in such a manner that they may be swung aside to the position shown in Fig. 3, in order to leave the boat free. To the plates nuts are screwed which engage bars mounted in the beams. These bars have a right-handed thread at one end and a left-handed thread at the other. To the outer ends of the threaded bars, wormwheels are secured which mesh with worms on a shaft journaled in the two cross-beams, and connected by bevel-gears with a vertical shaft operated by a hand-wheel.

In launching a boat, the hand-wheel is turned to separate the supporting blocks by the operation of the threaded bars which engage the plate-nuts previously mentioned. When the blocks are sufficiently drawn apart, they are swung down into the position shown in Fig. 3. The boat being thus left freely suspended, may be readily swung out over the ship's side and lowered by the ordinary tackle without the necessity of being first raised. The entire operation may be performed by a single person and in much less time than would ordinarily be required.



MATSON'S BOAT-LAUNCHING DEVICE.

Electrolytic Galvanizing.

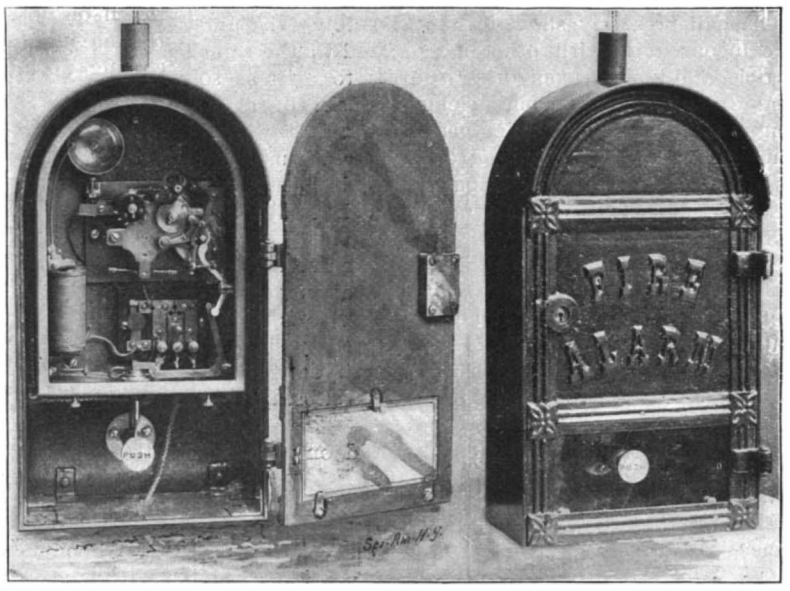
A company started some two years ago to introduce a new cold process for galvanizing, and now a number of plants are running. The New York plant, with a capacity of about two tons per day, galvanizes any kind of jobbing work, and fills sample orders for manufacturers to show the advantages of the process. A glance at the old method will show clearly by comparison the advantages offered by this new process. As is well known, zinc is the only metal which will effectively preserve iron from rusting, and therefore is used for galvanizing purposes. The process of zincing by heat is defective. It puts on much superfluous metal, leaving the surface of the object treated rough and uneven, and does not give a coating of uniform thickness and strong adherence. Screws and threads have to be recut after treatment, involving much extra labor. All such defects are claimed to have been overcome by this new process of electrolytic galvanizing. A multitude of articles can thus be galvanized. Screws, nuts, cutting instruments, tools of every description, springs, locks (inside and outside parts), umbrella frames and artistic metal articles can be treated. Screws and threads need no recutting; springs preserve their elasticity and temper. The coating adheres to the surface of the iron, and all designs retain their original forms. Iron sheets or wire can be bent, folded, twisted, etc., without injury to the galvanizing. The exposure of articles to atmospheric influences will not injure their rust-proof character, nor will salt water cause corrosion.

Cast and wrought iron, steel, brass and copper can be treated, and such articles afterward brassed, coppered or silver or gold plated for decorative purposes. A considerable reduction in cost of operating is effected, 80 to 90 per cent of spelter being saved, and there is also a saving in fuel. There is no dross, which in the old process consumes 30 to 50 per cent of zinc, and the use of sal ammoniac is avoided. The gradual depreciation of the expensive zincing kettle, caused by burning out, and the keeping up furnace fires day and night, essential with the old method, is entirely avoided. The size of the article to be galvanized is immaterial, it being merely a question of making tanks to correspond. The bath prepared for galvanizing is permanent and only requires an occasional addition of inexpensive chemicals. Ordinary zinc plates are used for anodes. The process can be made continuous—that is, the articles first put in the tank will be galvanized and ready to be taken out by the time the tank is filled with the material to be galvanized, provided it is made of sufficient size. Electrolytic galvanizing is particularly adapted to articles consisting of two or more movable parts, such as pulley blocks, gage tools, snap hooks, etc., as no parts are soldered together by the galvanic process.

AN IMPROVED FIRE-ALARM.

In many of the fire-alarms at present in use it is first necessary to open the door of the box by means of a key before sounding an alarm. Often the box is rendered useless by turning the key the wrong way, and sometimes the key is broken by not inserting it far enough in the keyhole. A fire-alarm invented by Harlie E. Greene and John W. Haley, of Hot Springs, Ark., seeks to overcome these objections by employing a box in which an alarm is sounded by breaking a glass plate and by operating a push-button. Our illustrations represent this improved fire-alarm with the door of its box opened and closed.

The outer casing of the box is provided with a hinged door having at its lower portion a glass panel. Secured to the lower portion of the inner wall of the casing is a slotted barrel, in which there slides the spring-pressed shank of a push-button. On the shank there rests a cam, the inclined upper surface of which engages a pin sliding in vertical guideways at right angles to the push-button. Through the medium of a series of spring-pressed levers this vertically-sliding pin operates a stop-lever engaging the notch of a stop-wheel journaled in the upper portion of the casing.



AN IMPROVED FIRE-ALARM.

The stop-wheel is connected by clock-gearing with a commutator wheel provided with two brushes, one of which is in fixed contact with the commutator and the other of which is adapted to engage contact points on the wheel. Two line-terminals are connected by wires with the two commutator brushes, one line-terminal being directly connected with one brush and the other having in the circuit bell-magnets and a bell, which may, however, be cut out whenever it is desirable or necessary.

When it is desired to send in an alarm the glass panel is broken, and the push-button is then forced in against its spring. The inclined surface of the cam will then raise the superposed pin; and the pin will operate the connected spring-pressed levers to raise the stop-lever from engagement with the notched stop-wheel. The clock-gearing will be set in motion and will drive the commutator-wheel so that the points thereon will complete and break the circuit as they alternately pass into and out of contact with the movable brush. The relation between the commutator and stop-wheels is such that the former will make two revolutions for a single revolution of the latter, thus sending in two alarms for one operation of the push-button. Should the fire-alarm circuit at any time be disabled by the burning-out of the magnet-coils, the magnets and bells can be cut out and direct communication established between the brush and terminal. The inventors claim that the fire-alarm will have a resistance no greater than 20 ohms, and that by cutting out the bell-coils the resistance is still further reduced, hence permitting the use of small battery-power in operating the lines.

The Incineration of Garbage in Hamburg.

At a recent meeting of the German Society of Public Hygiene, Meyer (Tribune médicale, N. Y. Med. Jour.) described the system employed in Hamburg for the cremation of garbage. It applies to the central part of the city, occupied by about half the population. The works consist of thirty-six Horsfall furnaces. The material to be burned is delivered in sealed metallic receptacles. Combustion is promoted by forcing warm, dry air into the furnaces. This is found to be superior to the English practice of employing steam. Except for kindling purposes, no adventitious fuel is required; the combustion is complete. The heat generated is turned to account in operating dynamo-electric machines for illuminating and other purposes.

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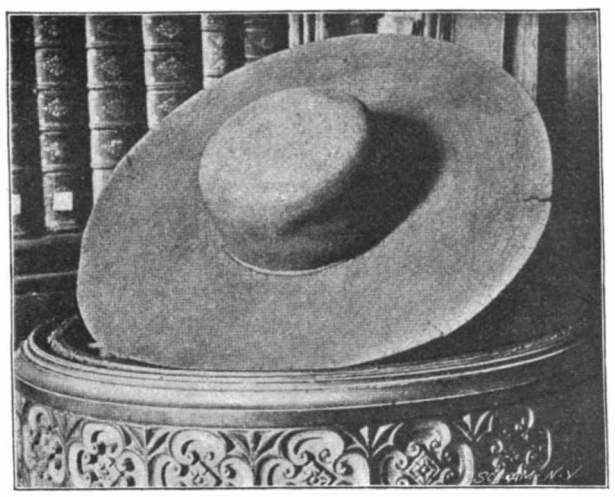
CARDINAL WOLSEY'S HAT.

Christ Church, Oxford, has secured a hat that once belonged to the great Cardinal Wolsey. Christ Church, Oxford, was founded by Henry VIII., in 1545, but, in reality, he merely adopted the magnificent work commenced by Cardinal Wolsey in 1524. It may be said that Christ Church, Oxford, is not a church, but a college. The great cardinal intended "Cardinal College" to be a splendid institution for the advancement of learning and a memorial of his own greatness. In order to create it he abolished monasteries, pulled down churches, collected costly vestments, and sent agents to buy manuscripts. A considerable part of the building was finished in 1529. He drew up statutes providing for a dean, fellows, and many graduates, scholars, and others, and appointed the first holders to



CARDINAL WOLSEY'S HAT.

these offices, and, curious to say, some of these turned out to be the pioneers of the Reformation. The college was at work when Wolsey fell, in October, 1529, and a year later the college was suppressed. Fifteen years later Henry VIII. re-established it under a new name, but the buildings were chiefly Wolsey's, and the endowments were taken from endowments provided by Wolsey.

Quite recently a new treasure was obtained by the college—a hat which is said to have been Wolsey's hat. While the pedigree of the hat is incomplete, it is ancient at any rate. For years it was one of the curiosities of the famous Strawberry Hill collection of Horace Walpole. When it was sold, it was bought by Charles Kean, the actor, who, it is said, wore it while he was acting. In 1898 it was exhibited at the Tudor exhibition, and in the same year it was bought and presented to Christ Church, where it will be very carefully preserved.

It has a large, flat brim of red felt; both brim and hat are absolutely round. The hat is 3½ inches high and 7½ inches in diameter. It is so very round that it is a wonder it could have been worn. The brim is perfectly flat and measures not quite 6 inches in width, so that the whole diameter of the hat and brim is about 19 inches. The tassels are lost, but the place where they went in can be seen. A narrow cord ran around the outside of the bottom of the hat along the inner edge of the brim and passed by two small holes through this edge, so that the ends of the cord could be brought together and tied. That it is a genuine cardinal's hat seems beyond doubt, but whether or not it is Wolsey's hat is, of course, open to question. We are indebted to Black and White for our engraving and for the foregoing particulars.

American Locomotives for the Barry Dock.

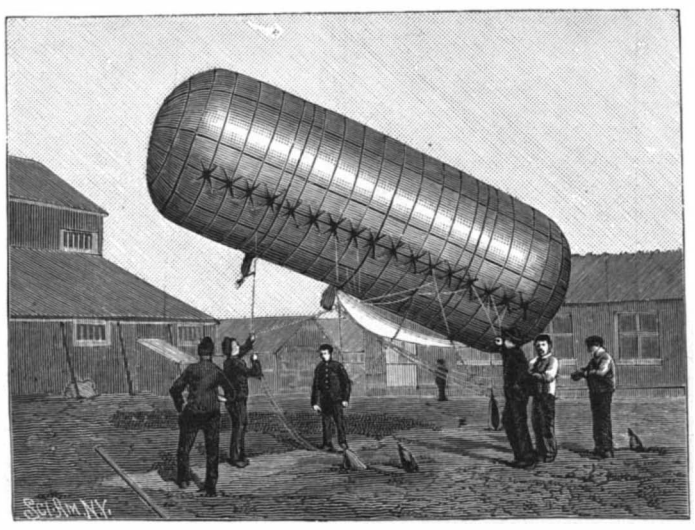
The directors of the Barry Dock have accepted American tenders for the construction of their locomotives. They get quicker delivery and the price will be about $500 less per engine.

MILITARY BALLOONING.

The idea of using balloons in warfare is more than a century old, the first attempt made to put the project into execution being in the Revolutionary War of 1794. Napoleon organized a ballooning corps for his second campaign in Egypt, but, before it could be employed, the wagons containing the accessories fell into the hands of the British. During the siege of Paris, in 1870, balloons were used extensively, and news was carried by that means from the beleaguered city to the provinces. Among the latest additions to military balloons are searchlights, which are regarded as invaluable in night reconnaissances.

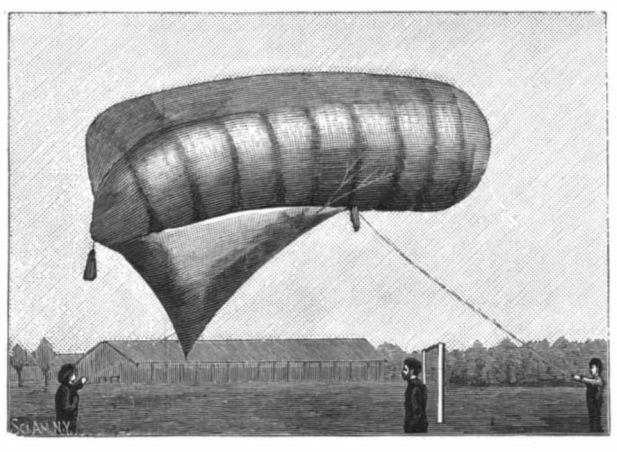
There is a military school of ballooning at Aldershot, says The London Graphic, which is wholly responsible for the theory and practice of aeronautics in the British army. This institution has not only to test every balloon destined for the service, but also to instruct those whose business it is to use the balloons, and to facilitate the employment of balloons generally in time of warfare. The balloon section of the Royal Engineers constructs all the appliances employed, with the exception of preparing and fitting the skins. All the nations of Europe are engaged in attempting to bring the science of aerial navigation to perfection. It is no doubt a serious matter to consider that, if ever the science were made really practical, not the finest navy ever seen could stop the destruction of a city by a military balloon armed with explosives. Experiments at Aldershot of late have been made with a balloon of a very different shape from that to which we are all accustomed. This new balloon is a weird-looking object, like a huge sausage floating in the air. It was, we believe, first tried in Germany. In the air the balloon floats at an angle of about forty-five degrees to the horizon. It is a somewhat complicated apparatus. In addition to the balloon itself there is a smaller balloon or bag attached, which has an open end, which inflates with air as the balloon moves. This helps to steady the balloon considerably. With the same object a small balloon, like a large football, is towed astern of the larger. This acts like the tail of a kite, and assists in keeping the balloon in the particular attitude it assumes, and also helps to maintain its steadiness. Oscillation is largely obviated, and special advantages for photographing are thus afforded. The little balloon at the tail also goes some way toward steering the balloon, for it enables the aeronaut to keep the head of what we will call the "sausage," for want of a better name, in a certain direction. This is a great advantage when the balloon is being towed, as, of course, it is generally captive. If let loose, the balloon would have to go before the wind, and the tail would still help in steadying it and keeping its head in the direction of the wind, which would never catch it athwart.

VESUVIUS was recently covered with a heavy snow fall while the crater was in eruption. The sight was a very strange one; three streams of red hot lava moving at one time through the white snow.

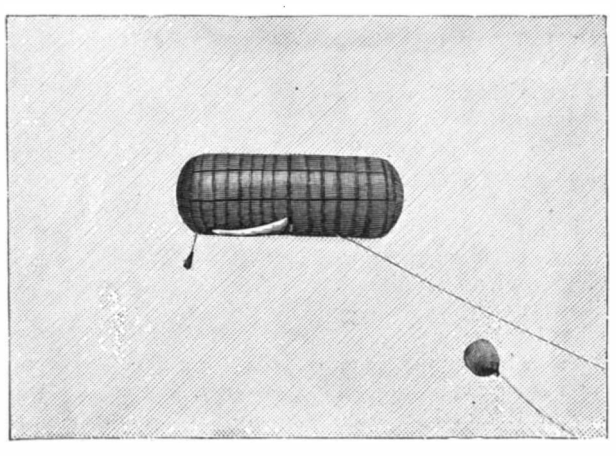


The Ascent.

Towing Home.



With Steadying Pouch Fully Inflated.



In Mid-Air.

AN ENGLISH MILITARY BALLOON.

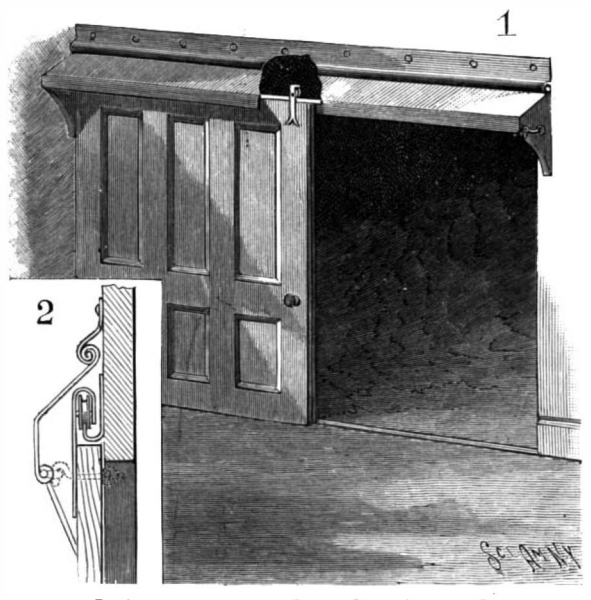
A CAP FOR SLIDING DOORS.

The illustration presented herewith represents an improvement in caps or devices for covering the tracks upon which sliding doors run, the improvement rendering it possible readily to repair the moving parts of the door-mechanism.

Fig. 1 is a perspective view of the device. Fig. 2 is a vertical section taken through the improvement.

Secured above the door opening is a plate which is bent to form a track for the door. Upon this track the door is hung by means of bars in which wheels are journaled, rolling upon the track. Above the track there is fastened to the wall a plate provided with an inwardly turned roll.

The cap which covers the track is also made in the



DOANE'S CAP FOR SLIDING DOORS.

form of a plate, but is provided with an outwardly turned roll intermeshing with the previously mentioned inwardly turned roll, so as to secure the two plates together and to form a hinge whereby the cap can be raised.

The cap extends down over the door and at its lower end is provided with a stiffening-rod held in place by a roll in the edge of the plate. At each end the cap is provided with eyes which are engaged by hooks. If it be so preferred, the eyes may be formed upon the ends of the stiffening-rod.

Should the wheels run off the track, or should the door become impeded, the cap is unhooked and swung up, thus enabling the necessary repairs to be made.

The cap has been patented by the inventor, Elias H. Doane, Tonica, Ill.

The Use of Peat Moss in Europe.

As we have had many inquiries concerning peat moss, we take pleasure in giving some additional particulars regarding this interesting substance which are furnished by United States Consul Listoe, of Rotterdam. The largest dealer in, and exporter of, peat moss in the Netherlands writes him as follows: Moss litter is used for the bedding of horses and cattle, while the peat dust is used for disinfecting purposes; that is to say, by mixing it with manure the moisture of the latter is absorbed and there is no unpleasant odor. It is also used as a packing material for fruit. Mixed with molasses, peat dust forms a fodder for cattle. This is mostly made in Germany, and the sales of this molasses fodder are daily increasing. The peat dust is sifted from the moss litter; the peat fiber is used in Holland to make horse clothes and carpets and also antiseptic wool for dressing horses. A few years ago there was established at Maestricht works for making peat wool, but the enterprise was not a success.

No paper is made from peat moss in Holland, and it is not believed it is a fit material for paper making.

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Miscellaneous Notes and Receipts.

Swiss Alpen Kraeuterbitter-Liqueur.—(Bitters-liqueur made from Alpine herbs.)—

Gentian root	500 grms.
Juniper berries	500 "
Galangal root	500 "
Angelica root	240 "
Thyme	120 "
Sage	120 "
Calamus	120 "
Ceylon cinnamon	120 "
Spirit 60 per cent	65 liters.

Digest eight days and add, after pressing and filtering, Malaga wine 5 to 6 liters. Water, up to 100. Color brown.—Colonialwaaren Zeitung.

Diamonds in a Volcano.—An interesting discovery from a geological view-point has latterly been made in the Witries Hoek Mountains, in Natal. On the summit of an extinct volcano near the edge of a lake filling the former crater, soundings have established the presence of a sand layer containing small diamonds. It would be instructive to know whether these diamonds were there accidentally or whether the find is connected with a diamond field, for the said mountains are not situated in a district known to be diamantiferous. Considering the latter supposition, the presence of precious stones in the crater of a volcano will doubtless throw some light upon the formation of precious stones in nature.—Die Edelmetall Industrie.

To Reproduce Old Lithographs.--Prepare a bath consisting of sulphuric acid, 3 to 5 parts, according to the age of the picture, thickness of the paper, etc., alcohol 2 to 5 parts, water 100 parts, in which the picture is immersed for 5 to 15 minutes, whereupon it is spread face downward on a glass or ebonite plate, allowing a weak jet of water to run over it for a time. If the paper is very thick, the sheet is turned over and the water is permitted to run over the face as well. Now remove the lithographic print, lay it on a piece of blotting paper, cover it with another, and dry the picture as far as possible between the two blotters.

The print, still somewhat moist, is then, with the picture upward, laid on a glass plate, well smoothed down and covered with a layer of weak gum solution, using a very soft sponge. The picture is now ready to take the printer's ink or lithographer's ink diluted with oil of turpentine, as is customary in lithographing. After this is done, spread a sheet of suitable paper on it and pass a dry roller over it. A reversed imprint is the result, which is transferred to a zinc plate or a lithographic stone, from which numerous impressions can be made.—Neueste Erfindungen und Erfahrungen.

Coating for Parts of Iron in the Open Air.—The iron parts are cleaned with suitable tools, the joints puttied up and priming is done with a paint consisting of iron minium and linseed oil varnish, which is applied twice. When the grounding is perfectly dry, coat twice with a paint consisting of white lead 1 kilo., zinc-gray 1 kilo., ultramarine 20 grammes, finely ground with 500 grammes of boiled linseed oil. Cast iron or wrought iron water pipes are painted with gas tar heated to 180° C. or with a mixture of asphalt 1 kilo. with colophony 1 kilo., which is thinned with tar oil.

A coating for iron which is impervious to fire is obtained as follows: First apply a water-glass solution which is mixed with finely powdered glass. After drying, lay on a thin paint consisting of quartzose sand 14 parts, powdered hammer-scale, slaked lime ½ part, clay ½ part, and water-glass solution as necessary.

Rust-proof paint for iron and steel.—Dissolve caoutchouc in benzine, and put on the thickish solution by means of a brush.

Coating for wrought iron pipes.—Boil 72 per cent of coal tar, free from oily substances, with 28 per cent of crude asphalt until the necessary consistency is reached. The mixture must not be overheated.—Centralzeitung für Optik und Mechanik.

Piercing Majolica and Porcelain.—Ceramic objects can be quite readily pierced with steel tools. Best suited are drills of ordinary shape, hardened like diamond and moistened with oil of turpentine, if the glaze or a vitreous body is to be pierced. In the case of majolica and glass without enamel the purpose is best reached if the drilling is done under water. Thus, the vessel should previously be filled with water and placed in a receptacle containing water, so that the gimlet is used under water, and, after piercing the clay body, reaches water again. In the case of objects glazed on the inside, instead of filling them with water, the spot where the drill must come through may be underlaid with cork. The pressure with which the drill is worked is determined by the hardness of the material, but when the tool is about to reach the other side it should gradually decrease and finally cease almost altogether, so as to avoid chipping. In order to enlarge small bore-holes already existing, three-cornered or four-square broaches, ground and polished, are best adapted. These are likewise employed under water or, if the material is too hard (glass or enamel), moistened with oil of turpentine. The simultaneous use of oil of turpentine and water is most advisable in all cases, even where the nature of the article to be pierced does not admit the use of oil alone, as in the case of majolica and non-glazed porcelain, which absorb the oil, without the use of water.—Metallarbeiter.

A CONVERTIBLE DUSTING-BRUSH.

The accompanying illustration represents a simple dusting-brush, so constructed that the handle, without being detached, may be shifted from one end of the brush to the other, so as to secure a uniform wear of the bristles.

Fig. 1 is a perspective view, showing the brush and handle arranged to form a long-handled brush. Fig. 2 is a side elevation showing the brush and handle arranged to form a floor brush. Fig. 3 is a transverse vertical section of the brush, the handle being omitted.

The dust-brush is provided with a tubular portion open at both ends, into which a double-ended handle is

HAM'S CONVERTIBLE DUSTING-BRUSH.

adapted to fit. At its upper face the tubular portion is provided with three apertures, one at each end and one at the center. At the bottom of the tubular portion, in transverse alinement with the central aperture, a depression is formed, as shown in Figs. 2 and 3.

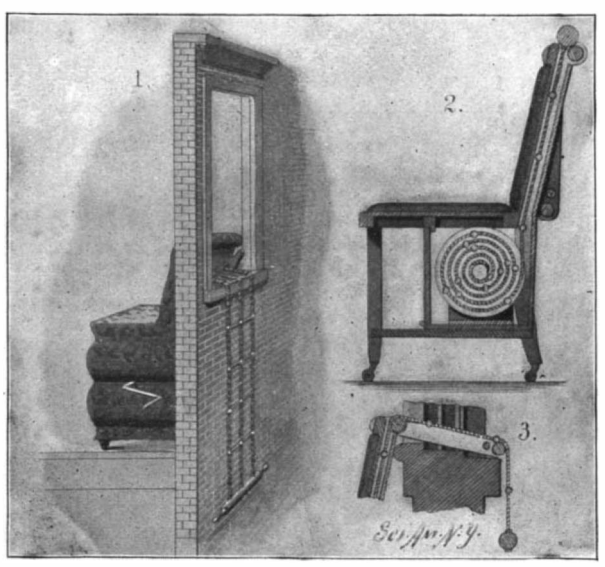
The handle at each end is provided with an aperture which is adapted to register with the end apertures of the tubular brush portion.

When the brush is to be used as a hand-brush, the handle is run through the tubular portion, and is secured by means of a pin which passes through the handle aperture and through one of the end apertures of the tubular portion.

By causing the pin to pass through one or the other of the end apertures, the brush can be converted from a short to a long-handled brush. Fig. 1, for example, shows the arrangement of the parts for a long-handled brush. When the brush is to be used as a floor brush, the handle is inserted in the central aperture of the tubular portion and into the depression registering with the central aperture, as shown in Fig. 2. The frictional engagement between the walls of the central aperture and depression and the handle is sufficient to maintain the handle in the brush body. It is evident that a brush thus constructed can be so arranged in its parts that the bristles may be evenly worn. The inventor is Henry H. Ham, of Portsmouth, N. H.

A NEW FORM OF FIRE-ESCAPE.

There has recently been patented by Emile Robiole, of 313 Amsterdam Avenue, New York city, a novel fire-escape, in which a piece of furniture is used as an anchor for the ladder.



A NEW FORM OF FIRE-ESCAPE.

Fig. 1 is a perspective view showing the fire-escape in operation. Fig. 2 is a section of a chair, showing the general arrangement of the parts of the fire-escape. Fig. 3 is a section of a portion of the device, showing the position of the parts when the ladder is running out of a window. The chair or other piece of furniture is provided with the usual seat and legs, and with a supplemental back behind the ordinary back. Below the seat a casing is arranged which communicates with the space between the two backs. In order to enable the chair to serve as an anchor, a heavy weight in the form of a plate is attached to the lower portion. Within the casing a spindle is mounted, upon which a fire-ladder, formed of steel wire cables to which steel rungs are secured, is wound. A portion of this ladder extends up between the two backs, and, at its outer end, is provided with a heavy weight normally resting upon the upper end of the back and upon a roller in the supplemental back. When not in use, the various parts will be in a position to enable the chair to be moved from place to place. When it is desired to use the fire-escape, the chair is moved to a window, as shown in Figs. 2 and 3, and the weighted end of the ladder thrown out of the window. As the window-sill might interfere with the downward movement of the ladder, the inventor has pivoted arms to the back of the chair, in the free ends of which arms a roller is journaled. This roller enables the ladder to unwind readily; and the connection of the arms with the piece of furniture is such that they will serve as braces to prevent the tipping of the chair. When the fire-escape is not in use, the arms will hang downward as shown in Fig. 2. In order to wind up the ladder after having been used, a winding-crank is employed which fits in a socket in the ladder-spindle.

A Rectifier for Alternating Currents.

For many purposes in which electricity may be used, says Dr. Kalischer in the Elektrotechnische Zeitschrift, the direct employment of alternating currents is not convenient. In consequence of this, one has been forced to make use of intermittent direct currents. But the rectifiers with movable parts finding employment for this purpose are more or less unreliable and irregular in their action, besides which a loss of energy is represented by the sparking which occurs at the contacts upon the opening and closing of the circuit. The substitution of a rectifier without these defects, and adapted to work in conjunction with alternating currents, would therefore appear desirable. This has been rendered possible by the recently published discoveries made independently by Messrs. Pollak and Graetz, who have utilized certain properties of aluminum to assist in rectifying alternating currents by employing anodes of this metal in conjunction with certain electrolytic solutions, such as, for instance, potash-alum and soda-alum. By this means a very great resistance may be opposed to the passage of the current in one direction, which is, indeed, quite prevented provided its E.M.F. does not exceed a certain maximum.

It is obvious from the foregoing that if we connect one or several such cells, as may be necessary (in series), possessing aluminum or lead or carbon electrodes in circuit with an alternate current generator and the primary winding of an induction coil, the current will be able to circulate through this winding only when the aluminum forms the cathode, so that the coil will be alternately choked and opened with perfect regularity. By employing two cells or group of cells, it is further possible to excite two inductions simultaneously, and so to fully utilize the current generated. It need hardly be added that a part of the alternating current may be employed for other purposes without in any way interfering with the action of the induction coils. Electro-plating baths might also be connected, as will be readily understood, and at the same time a portion of the current from the common source of generation transformed into a continuous current through the medium of the arrangement of connections suggested by Messrs. Pollak and Graetz.

The Manna of the Bible.

In a recent number of La Nature there is an interesting note by M. Henry Castrey on the manna of the desert, which played such an important part in the history of the Jews. At the present day Arabs who are compelled to traverse the sandy desert wastes of Arabia not only feed their camels upon this little known food, but also consume it themselves. The "manna" is really a fungus, the thallophyte, either Canona esculenta or Lichen esculentus. The fungus is very abundant and is found upon the sand after every rain, sometimes in great mounds or heaps. It is of a gray color and is about the size of a pea, and it breaks with a mealy fracture, and the taste is rather agreeable and somewhat sweet. When eaten it acts as a laxative, and the analysis shows that the fungus has the following composition:

	Per cent.
Water	16
Nitrogenous matter	14
Non-nitrogenous matter	29
Carbohydrates	32
Fat	4
Mineral matter	5

This analysis demonstrates the fact that the manna, while not a complete food in the strict sense of the term, is still rich in certain kinds of food material and it is capable of sustaining life for a time.

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Correspondence.

Lightning Protection.

To the Editor of the SCIENTIFIC AMERICAN:

Referring to the excellent article by Mr. Hopkins on "Lightning Protection" (SUPPLEMENT, March 25, 1899, page 19434), I beg to suggest that a protection fulfilling all the indications may be very cheaply arranged on a country house by nailing a few lengths of common barbed wire to the roof and bringing the ends to a point where they can be twisted around the iron pump of a driven well.

This gives an enormous number of points and a perfectly adequate water connection. The device was used many years ago by the late Dr. Henry J. Bigelow, of Boston, for the protection of a small isolated wooden house at Nantucket, and has apparently been perfectly effectual. W. S. BIGELOW, M.D.

60 Beacon Street, Boston.

German Steel Arch Bridges.

To the Editor of the SCIENTIFIC AMERICAN:

Your issue of March 25 will be read with great interest by all civil engineers interested in the introduction of bridges that will be more æsthetic in their design and still retain their stability, etc.

For the beautiful illustrations of the two bridges across the Kiel canal (Holstein, Germany), at Levensau and Grünenthal, you will have the acknowledgment and thanks of the entire profession.

As to the credit due in designing these bridges, I believe Mr. Müller v. d. Werra is in error. The bridge at Grünenthal was designed by Mr. Claus Greve, C.E., an assistant to Mr. Föltsch, chief engineer of the said canal and of late one of the commissioners appointed to examine into the practicability and cost of the Panama canal.

For above work Claus Greve received recognition and a decoration in person, during the time of its inauguration, by the Emperor of Germany.

H. ROHWER,
As. Eng. Mo. Pac. Ry.

Sedalia, Mo., April 6, 1899.

[Our correspondent is in error in supposing that the credit for designing the Grünenthal bridge was given, in the article referred to, to Prof. Krohn, the designer of the Levensau bridge. We are obliged to Mr. Rohwer for supplying us with the name of the designer of this notable structure, which was inadvertently omitted from the article.—ED.]

Twelve-pounders Better than Six-pounders for the Maine.

To the Editor of the SCIENTIFIC AMERICAN.

The description of the new battleships of the "Maine" class, recently given in the SCIENTIFIC AMERICAN, discloses the fact that they are to continue a feature for which our ships are already notorious—namely, the lack of a sufficient number of small rapid-fire guns. To give a first-class battleship, in the year 1899, a secondary battery composed of twenty-four 6 and 1-pounders seems incredible, especially in American ships, which have always had at least the reputation of a heavier armament for their size than any afloat.

The small rapid-fire gun has shown its value more and more every year. In the battle of the Yalu it did a great part of the execution on both sides. At Santiago the 6-pounders were responsible for a large proportion of the total damage inflicted. At Manila, the sweeping of the decks by these small guns contributed largely to the wretched showing made by the Spanish gunners. Moreover, at Santiago the two Spanish destroyers were principally demolished by the fire of these small rapid-firers.

Here are the three important battles so far fought with modern vessels, and in each of them the rapid-fire gun has played the predominant part.

There is also another event in which the ship's safety will depend almost entirely on the small rapid-fire guns—namely, a night attack by a torpedo boat fleet. Here every rapid-fire gun will count and the ship lacking them is sure to suffer.

A table comparing the "Maine" with representative foreign ships will be found somewhat startling.

Name.	Tons.	Armament.
Maine	12,500	Four 12 in., sixteen 6-in., twenty 6-pr., four 3-pr., four 1-pr.
Retwisan	12,700	Four 12-in., twelve 6-in., twenty 12-pr., twenty-eight smaller.
Tri Sviatetelia	12,840	Four 12-in., eight 5·9 in., four 4·7-in., fifty-six smaller.
Majestic	14,900	Four 12-in, twelve 6-in., eighteen 12-pr., twelve 3-pr., 8 m.
Bouvet	12,200	Two 12-in., two 10·8-in., eight 5½-in., eight 3·9-in., twelve 1·8-in., twenty 1·4-in.
Kaiser Wilhelm II	11,130	Four 9·4-in., eighteen 5·9 in., twelve 18-pr., twelve 1·4-in., 8 m.
Italia	14,387	Four 100-ton, eight 6-in., four 4·7-in., twelve 2·2-in., twenty-four 1·4-in., 2 m.
Asahi	15,200	Four 12-in., fourteen 6-in., twenty 12-pr., eight 3-pr., four 2½-pr.

The average number of rapid-fire guns on foreign ships is seen to be over forty. Compare with the "Maine" the Russian ship now building at Cramps, the "Retwisan," or the "Majestic," of the English navy. The "Retwisan" has nearly twice as many small rapid-fire guns as the "Maine," guns, moreover, of much greater power, consisting chiefly of 12 and 3-pounders, instead of our 6 and 1-pounders. The "Majestic" also shows this same superiority.

As is well known, the 3-pounder has a much greater range than the 1-pounder, and, of course, the 12-pounder is manifoldly more powerful than either. The 1-pounder is notorious for its short range, so short indeed that the gun would be seldom in range at the distances which modern artillery compels.

In the matter of small rapid-fire guns alone, both the "Majestic" and "Retwisan" are decidedly superior to the "Maine." The argument is made that the "Maine's" four extra 6-inch guns equalize the batteries; but no reason is apparent why our ships should not have a reasonable number of the small guns also.

The 6-inch guns on the upper deck of the "Maine" might be placed farther apart, forward and aft on each side, as in the "Canopus," so as to allow several smaller guns to be placed in the interval between them. Then, also, the two 6-inch guns would be in less danger of being put out of action by a single shot. Several small guns could also be placed on the boat deck. There is room for at least four more of these there, without interfering in any way with the boats.

Many foreign ships are overgunned. Possibly the Russian vessel now building at Cramps, the "Retwisan," has more guns than can be carried advantageously. The English, however, have always been extremely conservative in this respect; sometimes they have gone to the other extreme of undergunning their ships; but the constant feature of English ships, which may be always depended upon, is the reasonably small number of their guns.

Why, therefore, should the "Maine" carry twenty-eight of these all-important guns when the "Majestic" has thirty-eight—thirty-eight, moreover, of greatly superior power?

Why do we so completely ignore the lessons of the Spanish war, and drop our old tradition, its value so often proved, of well-gunned ships? L. F. B.

589 North State Street, Chicago, Ill.

[Our correspondent does not realize the enormous difference in power which results from increase of caliber. The four extra 6-inch guns on the "Maine" represent in their destructive power much more than the difference between the twenty 6-pounders of the "Maine" and the twenty 12 pounders of the "Retwisan."

However, his argument is on the whole well made; for it is officially stated that the 6-pounders will be replaced by 12-pounders before the ship is launched.—ED.]

The Telephone in the United States.

According to the annual report of the American Bell Telephone Company, last year 1,231,000,000 messages were sent. The company now has under rental 1,124,846 instruments. This is a gain of 205,725 during the year. On January 1 there were 1,126 exchanges, 1,008 branch offices, and 772 989 miles of wire. There was a total of 338,293 circuits, 19,668 employes, and 465,180 telephone stations. The estimated number of exchange connections daily in the United States by last account was 3,823,070. The cost to subscribers varied from less than 1 cent up to 9·4 cents per connection. These figures are of great interest when taken in connection with similar statistics of telephone service abroad. In 1898 the Bell Telephone Company had, as already stated, 465,180 exchange stations, while in Germany in 1897 there were only 173,981; in France, 45,000; in all of continental Europe, 453,844; in Great Britain and Ireland, at the end of 1898, 103,084.

Wireless Telegraphy.

The French government has commissioned Signor Marconi to install his apparatus experimentally on a cruiser. If the experiment proves a success, several French warships will be provided with the apparatus. The storm test of the Marconi system has been made, the wind blowing a gale in England and the rain storms were constant. Similar conditions prevailed at Boulogne, but the messages passed as readily and as distinctly as though the water was calm. Signor Marconi states that he thinks of coming to the United States in October to execute several commissions for fixing his apparatus between various towns.

The Cancer Microbe.

The Paris Figaro has announced that Dr. Bra has found the microbe of cancer, and that there is reason to hope that the discovery may soon lead to a certain cure of that dread disease. Dr. Bra is modest and cautious in his statements, saying that it must be months before a definite announcement would be possible. What he has succeeded in doing, however, is to isolate and cultivate a parasite from cancerous tumors and to produce therefrom cancer in animals. The parasite is fungus-like and is certainly the specific agent of cancer. Dr. Bra has spent some four years in his researches on the origin of cancer.

Science Notes.

Mr. L. W. Longstaff, a Fellow of the Royal Geographical Society, has donated $125,000 to the Society for the purpose of equipping a British Antarctic expedition. It is thought probable that the vessel to be fitted out will co-operate with the German expedition.

The Council of the British Association has selected Sir William Turner, F.R.S., professor of anatomy in the University of Edinburgh, as president of the Association for the Bradford meeting, which is to be held next year.

The Soudan bridge order which was given to a Pennsylvania firm is creating a great impression in England and has awakened bitter opposition. Some of the newspapers go so far as to say that the transaction was scandalous and that the specifications were altered in favor of the American contractors. This is denied by the builders of the bridge.

The Russian ice breaker "Ermak," which was designed by Admiral Makaroff, has reached Kronstadt, crushing the ice with ease. When the island of Sescar was sighted, large floes of ice varying in thickness from 9 to 10 feet were met with. The ice was broken into large pieces which floated astern, but so arduous was the task of getting through the solid mass that the rate of progress was but 2½ knots an hour.

There is a remarkable collection of astronomical photographs at Harvard University. They are kept by Mrs. M. P. Fleming, who is curator. The photographs taken at Cambridge and Arequipa are preserved and arranged in catalogues as is done with books, but the plates themselves are actually preserved, because no paper copy can repeat all the minute accuracy of the original negative on glass, and prints are not taken from them for scientific use, but only for illustration. If one is destroyed, it cannot be replaced. So it necessitates the greatest possible care in preserving them.

There is now an excellent chance of Boston having another Subway. The Committee on Metropolitan Affairs of the Massachusetts Legislature has given a hearing to the proposition of the Mayor for another Subway. The proposed route extends parallel with the Charles River on the Boston side and involves the tunneling of Beacon Hill. It is proposed to connect the new Subway with the existing Subway at Scollay Square. The cost of the new project is estimated at $3,000,000.

A special messenger of the American District Telegraph Company was recently sent by Mr. Richard Harding Davis from London with a letter to New York, one to Philadelphia, and one to Chicago. The boy was sent by the novelist in an effort to beat the Postal Union mail service, and this is undoubtedly the longest trip on record which a district telegraph boy has ever made. He is known at home as messenger No. 757; he is thirteen years old and rejoices in the name of Jaggers.

Mr. Jeremiah Head died on March 10. He was one of the best known consulting engineers in England. His paper read before the Institution of Civil Engineers in 1896 on the American and English methods of making steel plates, and a paper which he contributed in February to the same Institution in connection with his son on "Lake Superior Iron Ores," were a revelation to a large number of people in Great Britain who had not realized how rapidly Americans were forging ahead in the production of iron and steel, and the many improvements that had been introduced in transatlantic practice.

A task which has been undertaken in the interest of commerce was begun by the voyage of whalers to the Arctic Ocean, to test the Arctic currents. The effort to secure facts about the current and of the existence of a circular polar current was inaugurated by the Geographical Society of Philadelphia, backed by the United States government. Fifty patent casks of a peculiar make have been constructed in San Francisco, and will be sent out in the United States revenue cutter "Bear" and vessels of the whaling fleet. They will be distributed in different parts of the ocean and will be picked up by vessels which pass them later. It is thus hoped to determine the currents of the Arctic and the theory of an open current around the pole from the Atlantic to the Pacific.

Recently a curious sight was seen on Center Street, New York, when the old water tank of the Manhattan Company was exposed to view. April 2 was the centennial anniversary of the bank of the Manhattan Company. It was incorporated in 1799 for the purpose of supplying the small city with water. The real motive, however, was to organize a bank in opposition to the Bank of New York. In order to keep its charter, the company must supply water; so that the old tank has been kept in working order and the engine has been kept going pumping water. The tank is 40 feet in diameter. In 1840 the company had about 25 miles of wooden pipe and 14 miles of iron pipe. At about that time its usefulness as a water supply ceased and the Croton system came into use. From time to time these wooden and iron pipes are unearthed.

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NAVIES OF THE WORLD.

V.—GERMANY.

HISTORICAL.—In looking over the official list of the Germany navy, one is struck with the fact that it contains the name of only one ship, the "König Wilhelm," launched prior to the Franco-German war and the unification of Germany. The German navy has grown to its present proportions under the rule of the Emperors, and, particularly, under the fostering care of William II. At the outbreak of the war of 1870, there were but five ironclads to oppose the formidable fleets of France. The best of these was a fine broadside battleship, the "König Wilhelm," of 9,567 tons, which had just been completed in an English yard, and was armed with a powerful battery of eighteen 10-inch, four 8¼-inch, and six 5·9-inch breech-loading guns. Besides the "König Wilhelm" there were two broadside ships of 5,000 and 6,000 tons, and two small coast defense monitors. In addition to these there were some twenty-five gunboats and dispatch boats, and this little fleet of some thirty vessels was all owned by the one state of Prussia.

During the decade immediately following the war, Germany added to her navy four serviceable battleships of the belted and central citadel type so generally favored at that time, the "Kaiser," "Deutschland," "Preussen" and "Friedrich der Grosse"; and they were followed by the four central citadel and partially belted ships of the "Sachsen" class. These were all ships of from 7,000 to 8,000 tons displacement, 14 knots speed, and fairly powerful batteries of Krupp guns of the older patterns. Between 1876 and 1880 there were also built eleven small belted coast defense vessels of 1,109 tons and 10 knots speed, each armed with a 12-inch gun, and some score of small unarmored cruisers and gunboats were added to the navy.

The decade 1880–90 was marked by an almost total stagnation in the construction of armored ships, only one small battleship, the "Oldenburg" of 5,200 tons and 13·5 knots speed, being added to the navy, if we exclude one or two of the above mentioned coast defense vessels which were completed in 1880–81. The new construction during this period was confined to gunboats and small cruisers. Two of the former were built, and fourteen of the latter, the cruisers being, with two exceptions, vessels of 2,000 tons displacement and less, and several of them possessing a speed of 14 knots and less. The most important of these ships were the protected cruisers "Irene" and "Prinzess Wilhelm" of 4,400 tons and 19·8 and 18·7 knots speed, launched in 1887.

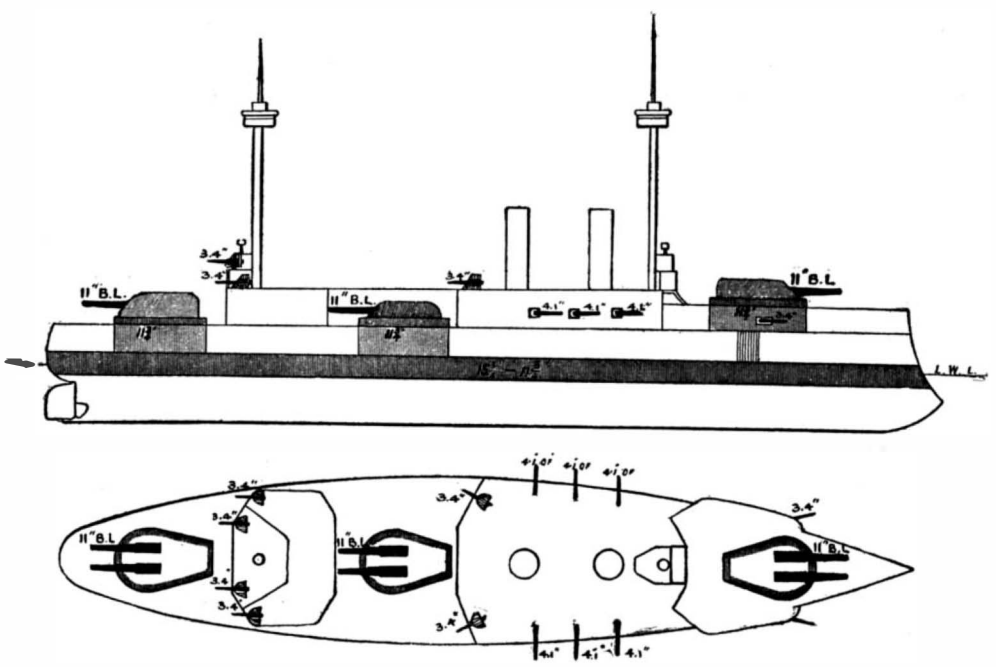
When the present Emperor came to the throne, the German navy, in comparison to the magnitude and growing importance of the merchant marine, was altogether inadequate, and the young Kaiser, who is an ardent yatchsman and, like his brother Henry, a thorough sailor at heart, set himself with characteristic energy to the work of reconstruction. For the ten years of his reign he has exerted all the powerful prestige and influence of his position to bring the German people to realize the necessity for creating a navy commensurate in numbers and power with the growing commercial interests of the Fatherland. His efforts have been crowned, first with partial, and latterly with complete, success. In the first half dozen years of his reign he has seen that splendid quartette of first-class battleships known as the "Brandenburg" class added to the navy, together with the eight effective coast defense vessels of the "Siegfried" type, while in the last five years the cruiser classes have been augmented by such vessels as the "Kaiserin Augusta," the "Gefion" and the effective vessels of the "Hertha" type.

The crowning success of the Emperor's policy, however, was witnessed in the passage last year of the famous Naval Septennate Programme.

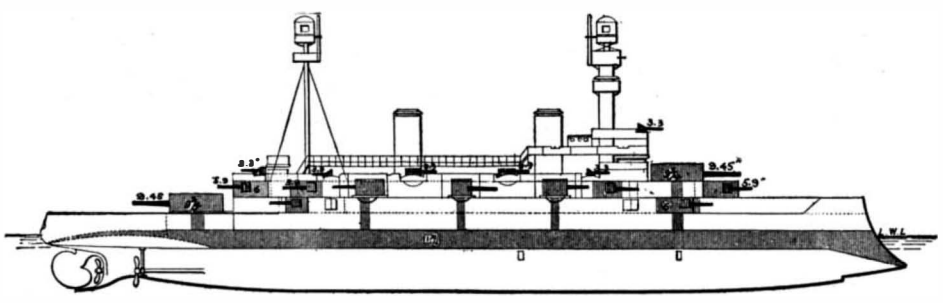
The Naval Septennate bill (so named because it is patterned after the system adopted for the army) provides for the creation of what is practically a complete new navy, the construction and cost of which was to have been spread over a period of seven years; although as finally passed the period is limited to six years. The bill provides, in addition to new torpedo boats and gunboats, for the raising of the strength of the navy to 17 battleships, 8 coast defense vessels, 9 large cruisers and 26 small cruisers. This will involve the construction of 7 new battleships, 2 large and 7 small cruisers, and new gunboats and torpedo boats, which will be built to take the place of obsolete vessels of this class that will be removed from time to time from the active list. The total cost will be about $103,000,000 and the ships will all be in commission by the close of 1904.

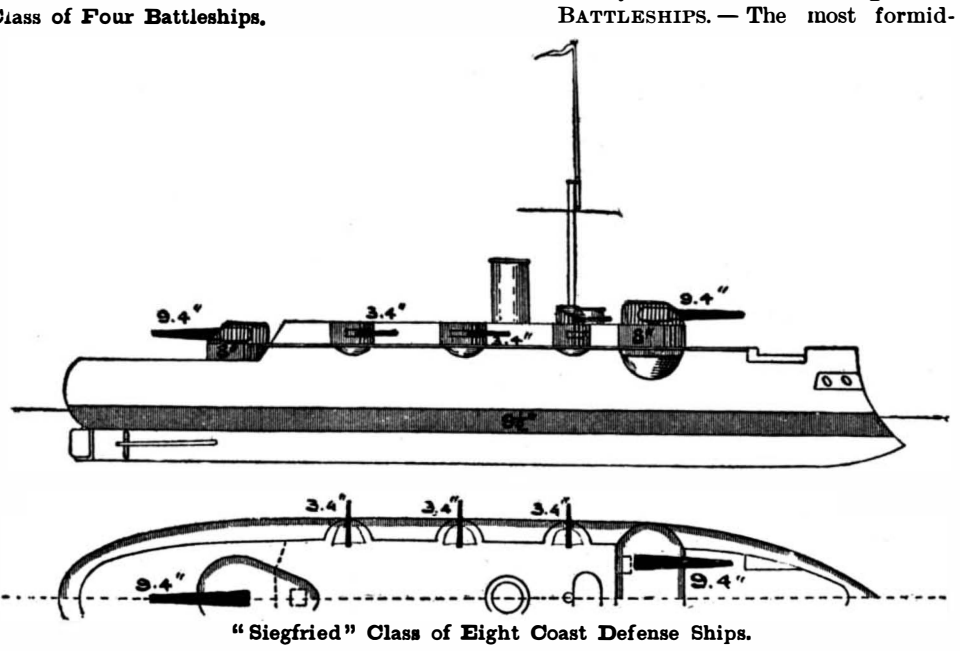
PRESENT STRENGTH OF THE NAVY.—On the first of January, 1899, the German navy, reckoning on the basis assumed in our comparative estimate of the navies of the world (SCIENTIFIC AMERICAN, December 31, 1898) included the following ships as built or building: 19 battleships, 1 armored cruiser, 12 protected cruisers of between 2,000 and 7,000 tons displacement, and 22 small cruisers and gunboats—a total of 73 vessels with an aggregate of 299,637 tons displacement. This places Germany between the United States with 303,070 tons and Italy with 286,175 tons total displacement. If the United States should keep up the rate of increase which has marked the last two years, during the years covered by the German Septennate bill, this country will have greatly increased its lead over Germany by the close of 1904; but unless Italy should increase her present rate of progress, she will fall yet further behind the northern navy in numbers and strength.

BATTLESHIPS.—The most formidable ships in commission in the German navy are the four powerful battleships of the "Brandenburg" class. The striking feature of these ships is the power of the main battery, which includes six, in place of the customary four heavy guns. The only other warships that are thus distinguished are the Russian battleships of the "Sinope" class, which carry six 12-inch B. L. rifles within a central barbette. The "Brandenburg's" guns are not so heavy, being of 11 inches caliber, but they are better distributed, and she is able to concentrate all six guns on the broadside, which the "Sinope" cannot do, although she can train four guns ahead, against the "Brandenburg's" two. The guns of the "Brandenburg" are better protected, as the breech of the guns is covered with a shield, while the Russian gunners must work in an

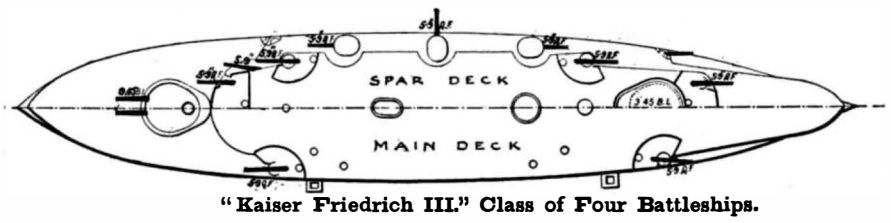


"Brandenburg" Class of Four Battleships.

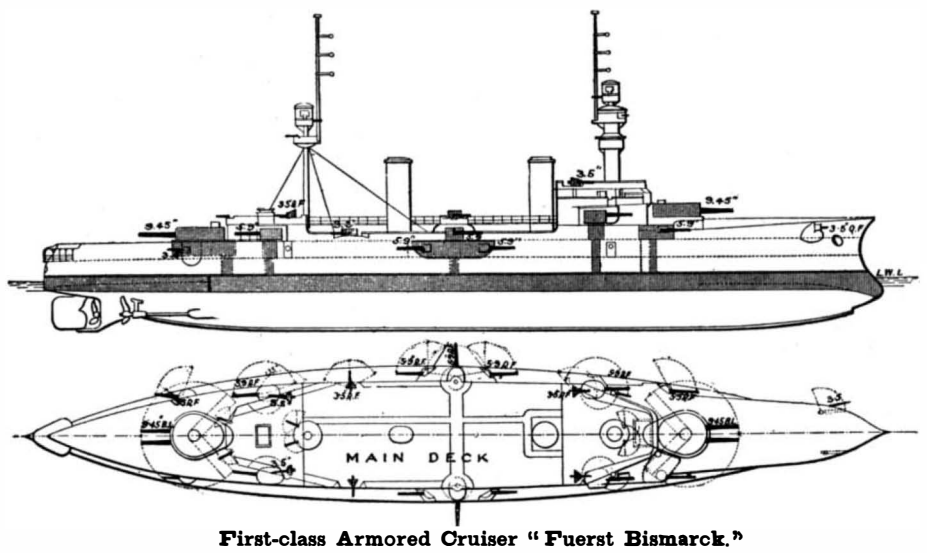




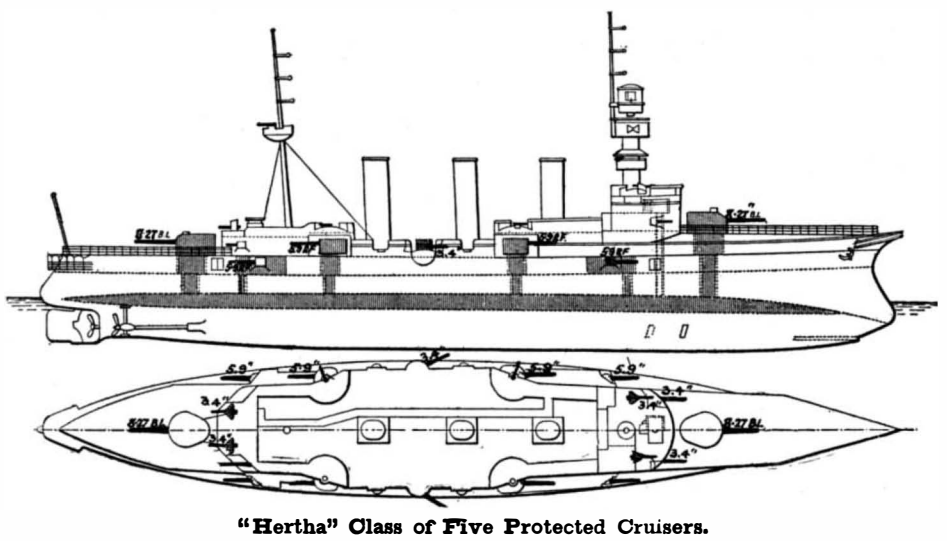
"Siegfried" Class of Eight Coast Defense Ships.



"Kaiser Friedrich III." Class of Four Battleships.



First-class Armored Cruiser "Fuerst Bismarck."



"Hertha" Class of Five Protected Cruisers.

NAVIES OF THE WORLD—V. GERMANY.

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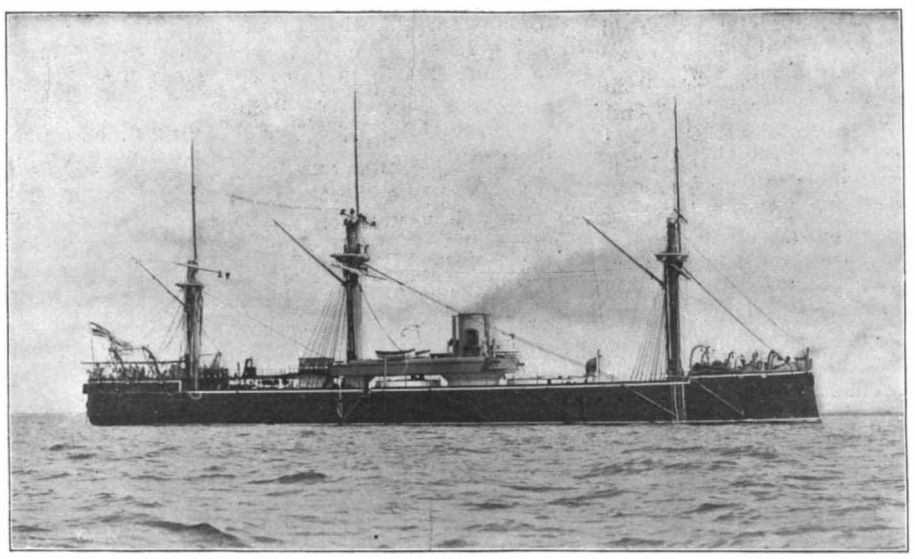
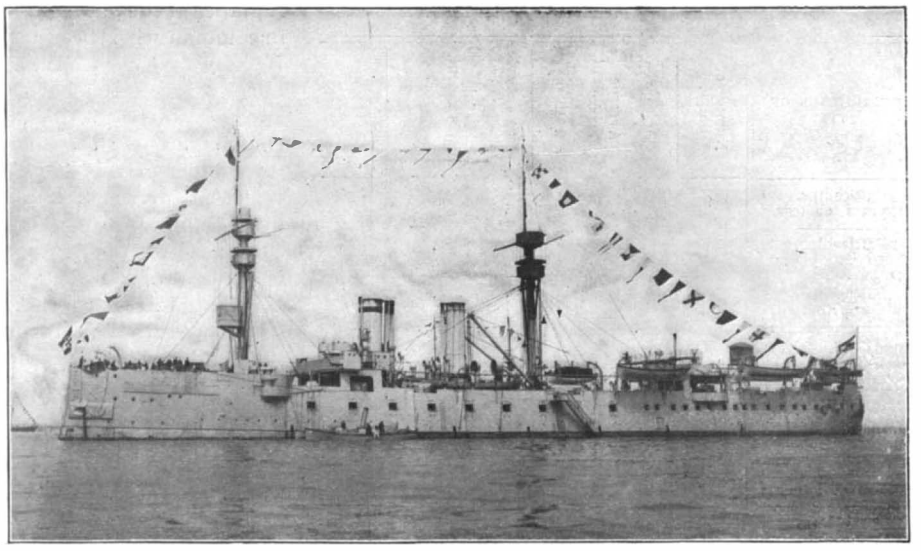
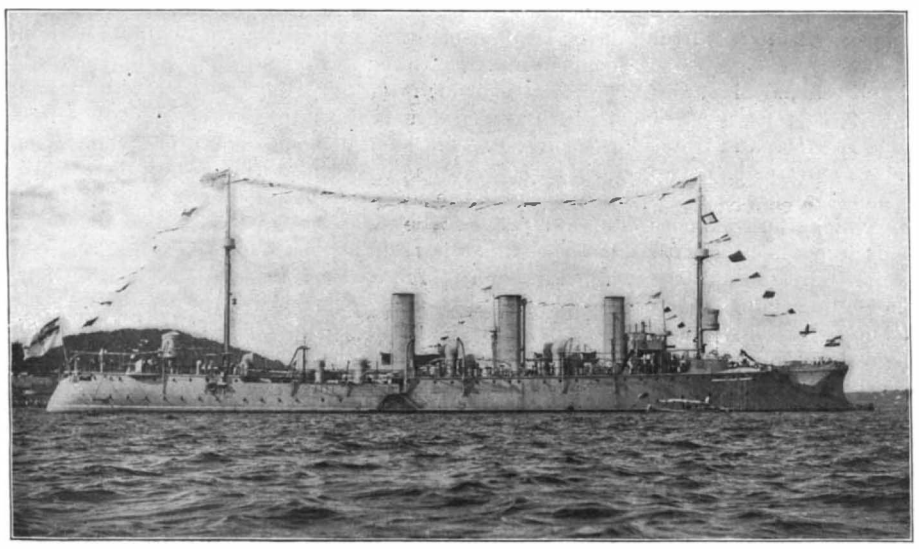


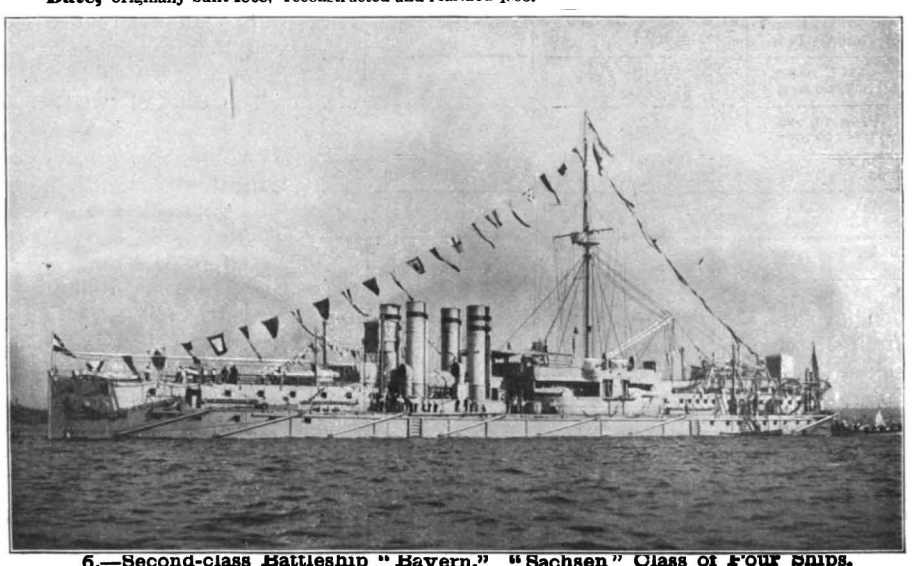
3.—Third-class Battleship "Preussen." Also "Friedrich der Grosse."
Displacement, 6,770 tons. **Speed,** 14 knots. **Normal Coal Supply,** 550 tons. **Armor:** Belt 9 inches; gun positions, 8 inches. **Armament,** four 10·2 B. L. rifles, two 6·6-inch B. L. rifles, ten 3·4 inch rapid-fire guns, six machine guns. **Torpedo Tubes.** 4. **Complement,** 537. **Date,** 1873.



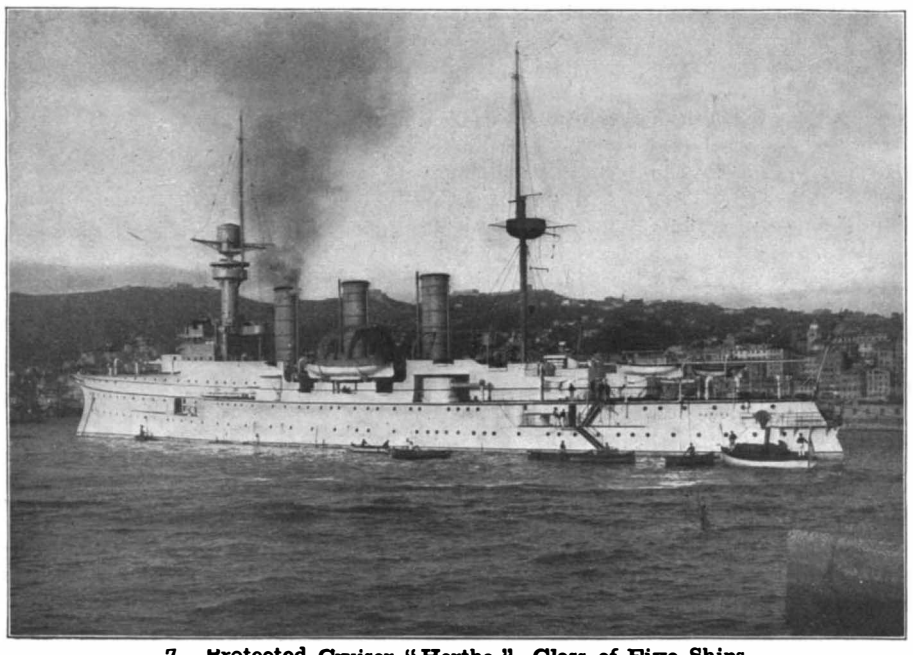
4.—Reconstructed and Rearmed Battleship "Koenig Wilhelm."
Displacement, 9,757 tons. **Speed,** 14·7 knots. **Normal Coal Supply,** 700 tons. **Armor:** Belt, 12 inches; gun positions, 6 inches; deck, 2½ inches. **Armament,** twenty 5·9-inch rapid-fire guns, eighteen 3·4-inch rapid-fire guns, eight machine guns. **Torpedo Tubes,** 5. **Complement.** 759. **Date,** originally built 1868; reconstructed and rearmed 1896.



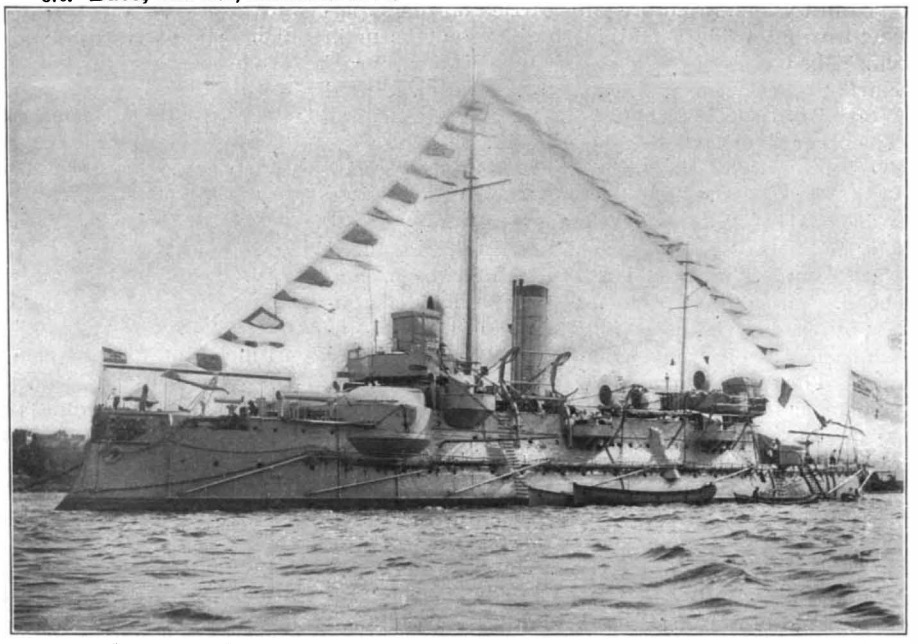
5.—Protected Cruiser "Gefion."
Displacement, 4,207 tons. **Speed,** 20 knots. **Normal Coal Supply,** 950 tons. **Armor:** 3-inch deck; gun positions, 3½ inches. **Armament,** eight 5·9-inch rapid-firers, ten 4·1-inch rapid-firers, six 1·9-inch rapid-firers, two machine guns. **Torpedo Tubes,** 2. **Complement,** 312. **Date,** 1893.



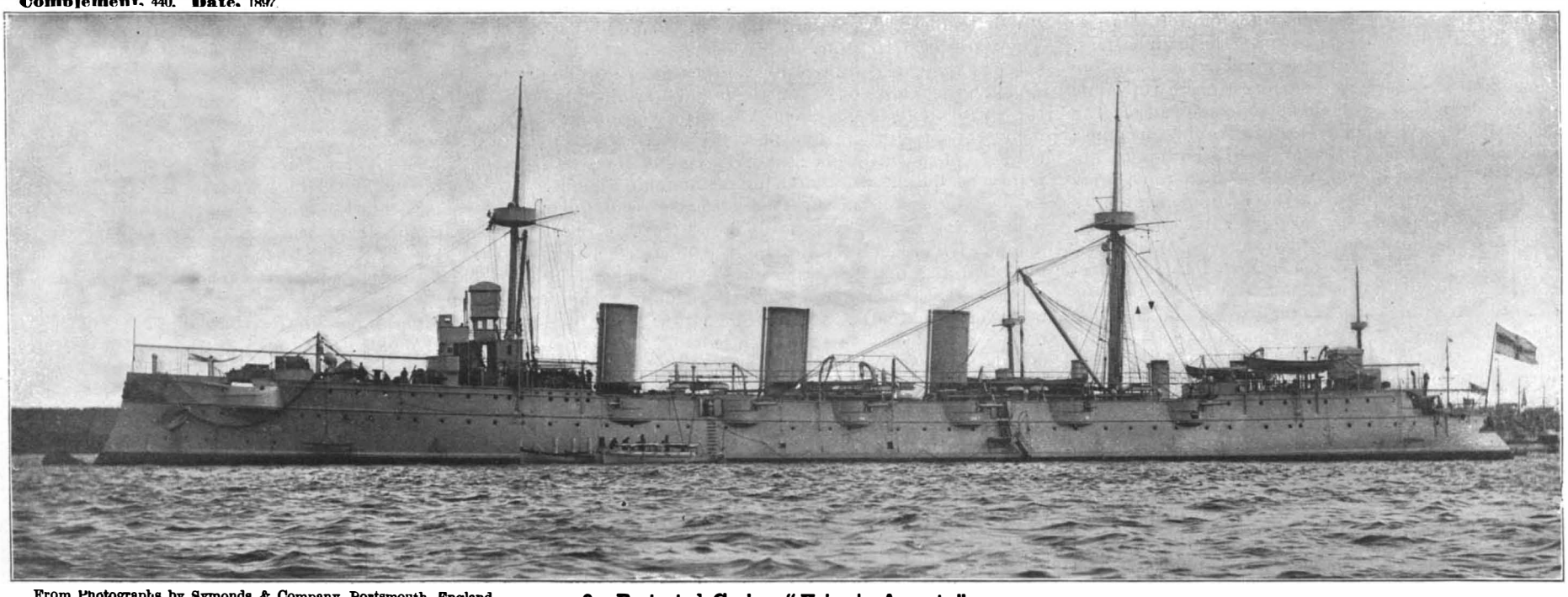
6.—Second-class Battleship "Bayern." "Sachsen" Class of Four Ships.
Displacement, 7,441 tons. **Speed,** 14 knots. **Normal Coal Supply,** 700 tons. **Armor:** Belt, 16 inches; gun positions, 10 inches; deck, 3 inches. **Armament,** six 10·2-inch B. L. guns, eight 3·4-inch rapid-fire guns, eight machine guns. **Torpedo Tubes,** 5 (2 submerged). **Complement,** 376. **Date,** built 1878; reconstructed 1896.



7.—Protected Cruiser "Hertha." Class of Five Ships.
Displacement, 5,650 tons. **Speed,** 20 knots. **Normal Coal Supply,** 500 tons. **Armor:** Gun positions, 4 inches; deck, 4 inches. **Armament,** two 8·2-inch rapid-firers, eight 5·9-inch rapid-firers, ten 3·4-inch rapid-firers, ten 1·4-inch rapid-firers, four machine guns. **Torpedo Tubes,** 3 (submerged). **Complement,** 440. **Date,** 1897.



8.—Coast Defense Vessel "Heimdall." "Siegfried" Class of Eight Ships.
Displacement, 3,500 tons. **Speed,** 16 knots. **Normal Coal Supply,** 225 tons. **Armor:** Belt, 9¼ inches; gun positions, 7¾ inches; deck, 3 inches. **Armament,** three 9·4-inch B. L. rifles, eight 3·4-inch rapid-fire guns, six machine guns. **Torpedo Tubes,** 4. **Complement,** 225. **Date,** 1892.



From Photographs by Symonds & Company, Portsmouth, England.

9.—Protected Cruiser "Kaiserin Augusta."
Displacement, 6,331 tons. **Speed,** 22·5 knots. **Normal Coal Supply,** 850 tons. **Armor:** Shields, 3½ inches; deck, 3½ inches. **Armament,** twelve 5·9-inch rapid-firers, eight 3·4-inch rapid-firers, eight machine guns. **Torpedo Tubes,** 5. **Complement,** 427. **Date,** 1892.

NAVIES OF THE WORLD—V. GERMANY.

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GERMAN NAVY, JANUARY 1, 1899.

DESCRIPTION OF TYPE.	Number of Ships.	Average Displacement.	Total Displacement.	Average Speed.
Battleships, 10 years or less,	9	10,672	96,048	17·3
Battleships, 10 to 20 years.	1	....	5,200	13·5
Battleships, Old or Refitted.	9	7,434	66,910	14·0
Totals.....	19	....	168,158	...
Coast Defense Vessels.	19	2,081	39,539	12·6
Armored Cruisers, 9,000 tons and up.	1	10,650	10,650	19 0
Armored Cruisers, 7,000 to 9,000 tons.	....	....	....	....
Armored Cruisers, Below 7,000 tons.	....	....	....	....
Totals.....	1	....	10,650	....
Protected Cruisers 10,000 tons and up.	....	....	.....	....
Protected Cruisers 7,000 to 10,000 tons	....	....	....	....
Protected Cruisers 4,000 to 7,000 tons	9	5,315	47,835	20·1
Cruisers, 2,000 to 4,000 tons.	3	2,225	6,675	21·25
Totals	12	....	54,510	...
Small Cruisers and Gunboats.	22	1,205	26,510	16·0
Grand totals.....	73	..	299,637	....

open barbette, and would be at the mercy of well-timed shrapnel. One pair of guns is mounted on the main deck aft, another pair on the same deck amidships, while the forward pair is carried on the forecastle deck, at a height, probably, of about 22 feet above the sea. The belt is continuous and tapers from 15¾ inches amidships to 11¾ inches at the ends; the gun positions carry 11¾ inches of armor, while the speed and coal capacity of 16 knots and 750 tons are only moderate. The power of the main battery is secured at the expense of the secondary rapid-fire battery, which is comparatively light. It consists of six 4·1-inch rapid-fire guns, mounted in broadside within the superstructure, and eight 3·4-inch rapid-fire guns carried on the superstructure and bridges and in the bow on the main deck. The vessels of this class are the "Brandenburg," "Kurfürst Friedrich Wilhelm," "Weissenburg," and "Wörth."

The other five battleships of the first class are the powerful vessels of the "Kaiser Friedrich III." class now under construction. Three of these, the "Kaiser Friedrich III.," "Kaiser Wilhelm II." and "Ersatz König Wilhelm," are launched and well advanced toward completion, while two others have been commenced. These ships are in many respects a class entirely by themselves, possessing features which distinguish them sharply from the latest battleships of other navies. They represent the latest ideas of the German designers as to what are the requirements of a modern first-class battleship, and as such they are to be compared with our "Maine," the British "Magnificent," the French "Charlemagne," the Italian "Re Umberto" or the Japanese "Fugi." The displacement, 11,130 tons, is moderate, being about the same as that of the "Charlemagne," 1400 tons less than that of the "Maine," 1,000 tons less than that of the "Fugi," while the "Re Umberto" and "Majestic" exceed it by 2,700 and 3,700 tons respectively. Bearing in mind the moderate size of the "Kaiser Friedrich III.," it is evident that her armament is extremely powerful. The German dislike of bulky ordnance is seen in the fact that the ship does not carry a larger caliber than 9·45, four of this size placed in 9¾-inch turrets constituting the main battery. These guns, however, are of the rapid-fire type and fire a 474-pound projectile with a muzzle energy of 17,340 foot-tons and a penetration of 23½ inches of steel. The secondary battery includes thirty rapid-fire guns; namely, eighteen 5·9-inch rapid-firers, each in separate turrets and casemates, and twelve 3·3-inch rapid-firers mounted behind shields, while this is supplemented by a score of one-pounders and machine guns.

The important problem of distribution has been well worked out, the larger guns being carried at four different stages above the water. The lowest are the two 9·4-inch in the after turret on the main deck and the four 5·9-inch in casemates, two forward and two aft on the main deck. On the spar deck above are six 5·9-inch in turrets on the broadside and eight 5·9 inch in casemates, four forward and four aft. Forward in a turret on the superstructure deck and 30 feet above the water is the remaining pair of 9·4-inch rifles, and ten 3·4-inch rapid-firers are carried at the same height in broadside and astern on this deck, while another pair of 3·4-inch guns is mounted on the upper bridge at a height of 46 feet above the waterline. The concentration of fire is two 9·4-inch, eight 5·9-inch and six 3·4-inch ahead; four 9·4-inch, nine 5·9-inch, and six 3·4 inch on either beam; and two 9·4-inch, eight 5·9-inch and four 3·4-inch astern. A glance at the plan and longitudinal section, for which, in common with the other diagrams, we are indebted to Brassey's Naval Annual, shows how difficult it would be for a successful shot to wreck more than one or two gun positions at a time. The belt armor varies from 11¾ to 6 inches; the main turrets are 9¾ inches and the smaller turrets and casemates 6 inches thick. The vessels are driven by triple screws, steam being supplied by a combination of cylindrical and Thornycroft boilers. The speed is to be 18 knots. Altogether we must confess to a strong liking for these vessels. Their tremendous rapid-fire batteries, the unusual end-on fire, the wide separation of their guns, their admirable protection, and the great height at which the guns are carried should render them exceedingly efficient ships, if well handled.

The weak feature is the unprotected bases of the casemates and turrets. In this respect the "Brandenburg" would be at a great disadvantage in a stand-up fight with our own "Maine" or the British "Magnificent." But one cannot have everything, particularly in a battleship.

In the class of "battleships from ten to twenty years old" (see table) Germany possesses one ship, the "Oldenburg," launched in 1884, of 5,200 tons, 13·5 knots, 13-inch belt, and carrying eight 9·4-inch guns within a central redoubt of 8-inch armor.

The class of "battleships old and refitted" includes nine ships of between 6.770 and 9,757 tons, most of which have been reconstructed and rearmed and transformed into useful fighting ships. Our readers who follow closely the progress of naval affairs will remember that this is the policy which Lord Charles Beresford so strongly recommends in connection with the many old broadside battleships built some thirty years ago and armed with muzzle-loading guns, which still remain on the active list of the British navy, and we think that Germany has shown good judgment in carrying out the change on her early ships. The most notable instance of this change is the thirty-one year old "Koenig Wilhelm," of which we present an illustration. Originally she was three masted and fully rigged, while her armament consisted of heavy slow-firers of an obsolete pattern. Her mizzenmast has been removed altogether, the fore and mainmasts have been cut down, the yards removed and fighting tops fitted. The old guns have been replaced by a numerous battery of twenty 5·9 inch and twelve 3·4-inch rapid-fire guns, while five torpedo dischargers have been fitted. She carries a 12-inch iron belt and 6 inches of armor on the gun positions, while the 3·3-inch guns are protected by shields. In her reconstructed state she is listed as an armored cruiser; but, on account of her low speed, we have thought best to place her and the other reconstructed or rearmed vessels in the battleship class.

The "Kaiser" and "Deutschland," built in 1874, of 7,531 and 7,319 tons and 14·5 knots speed, are sister ships with complete 10-inch belts. They each carry eight 10·2-inch breech-loading rifles, while the secondary battery of the "Kaiser" consists of one 5·9-inch, six 4·1-inch, and nine 3·4-inch rapid-fire guns, and that of the "Deutschland" contains seven 5·9-inch and nine 3·4-inch rapid-fire guns, both vessels having the usual complement of machine guns.

The "Preussen" and "Friedrich der Grosse," sister ships of 6,770 tons and 14 knots speed. were built in 1873–74. They have been relieved of their top and top-gallant masts and yards and their batteries have been modernized by the addition of ten 3·4-inch rapid-fire guns and several machine and light guns. They are protected by a complete belt of 9-inch armor, and the main battery of four 10·2-inch Krupp guns is carried in two 8-inch turrets within a central redoubt.

The four second-class battleships of the "Sachsen" class, the "Sachsen," "Baden," "Bayern," and "Württemberg," were built between 1877 and 1890. They are of 7,441 tons displacement and 14 knots speed. They are protected by a short belt of 15¾-inch armor, which only covers a little more than a third of the length amidships, although there is a continuous 3-inch protective deck. The belt, however, extends to the level of the main deck and, in conjunction with transverse bulkheads, forms a big rectangular redoubt. At the after end of this structure a smaller rectangular redoubt rises to the level of the superstructure deck, and at each corner of the redoubt is mounted a 10·2-inch Krupp gun. Two other guns of the same caliber are carried at the forward end of the redoubt, within a pear-shaped barbette. Eight 3·4-inch guns are carried upon a boat deck above the after redoubt. The ships of this class were reconstructed and refitted in 1896.

COAST DEFENSE VESSELS.—Germany has nineteen of this class all told, eleven of the early "Wespe" class, 1876 to 1881; and eight of the "Siegfried" class, 1890 to 1895. The "Wespe" class have already been described. Although they are of only 1,109 tons displacement, they mount a 12-inch gun forward in an 8-inch barbette, two 3·4-inch rapid firers aft, and have a continuous belt of 8-inch armor. They also carry two torpedo discharge tubes.

In the "Siegfried" and her class the German navy possesses some excellent coast defense vessels, of a design which we could wish to see substituted for our own monitors. They have a serviceable speed of 16 knots, a freeboard of 18 feet, three 9·4-inch guns, of which the forward pair have a command of 24 feet; they have a secondary battery of eight 3·4-inch rapid-fire guns and they carry four torpedo tubes. While the moderate draft of 17 feet 9 inches would enable them to enter any harbors, they could at any time join in a fleet action on the high seas. All this is secured on a displacement of 3,500 tons. If three 10-inch guns in two barbette turrets were substituted for the three 9·4-inch, the displacement being raised to 4,000 tons, these ships would be ideal coast defenders, and infinitely superior to the obsolete monitors which we are now engaged in constructing.

ARMORED CRUISERS.—Germany had only one armored cruiser, the "Fuerst Bismarck," constructing at the opening of the year, though a sister ship, the "Prinz Adalbert," has since, we believe, been commenced. As will be seen from the diagram on page 250, the armament will be made up of the same caliber of guns as that of the new battleships, and she will be almost as well protected, the deck being the same, and the vertical and turret armor only from 2 to 4 inches less in thickness. The particulars are as follows: Displacement, 10,650 tons; speed, 19 knots; normal coal supply, 1,000 tons; armament, four 9·4-inch rapid-fire, twelve 5·9-inch rapid-fire, ten 3·4-inch rapid-fire, ten 1·4-inch and eight machine guns, six torpedo tubes (five submerged). The complement will be 565 men. The ship is remarkable for the abnormally high freeboard forward and the lofty command of the guns, and she should prove to be a most effective fighter, although her speed, in view of the fact that the latest English and French armored cruisers are to steam 23 knots, is very low.

PROTECTED CRUISERS.—The largest and fastest of the protected cruisers is the "Kaiserin Augusta," familiar to many Americans because of her presence at the Columbian Naval Review at New York. She is the longest vessel in the navy and her horse power exceeds that of any other vessel. Her trial speed was 22·5 knots, and in this respect she is likely to remain for a time the crack ship of any fleet to which she may belong. The main armament of twelve 5·9-inch rapid-fire guns is carried in sponsons on the main deck, and the eight 3·4 inch rapid-firers are carried partly on the spar deck and partly on the main deck. The protective deck has a maximum thickness of 3 inches. The practice of placing all of the main battery on one deck exposes it to disablement by a raking fire, and, as we shall show, the fault has been remedied in the later cruisers of the "Hertha" class.

We also illustrate the "Gefion," launched in 1893, a slightly smaller vessel than the sister ships "Irene" and "Prinzess Wilhelm," which were launched six years earlier. The particulars of the "Gefion" are given under the cut of the vessel. The "Irene" carries four 5·9-inch and eight 4·1-inch rapid-fire guns and fourteen smaller guns. Her speed is 19·8 knots. This vessel is specially interesting as having figured prominently in the press dispatches from Manila during the recent Spanish war.

There are also completed or building the five effective vessels of the "Hertha" class. It will be noticed from the diagrams that, within the limits of their class, they have the same characteristics as the new armored cruisers; lofty freeboard, high command for the guns, wide distribution of the gun positions, and a complete rapid-fire armament carried in turrets and casemates. These ships compare favorably with any ships of their class in the world, and in the ratio of total gun-fire per minute to displacement they are only surpassed by some of the Armstrong boats built for South American republics. There are also constructing or built three other cruisers of 15 knots speed and over: Cruiser "G," 2,650 tons, 19·5 knots speed, and the sister ships "Greif" and "Hela," 2,000 tons and 23 and 20 knots speed respectively.

CRUISERS AND SMALL GUNBOATS.—The vessels of this class, twenty-two in all, call for no special notice. There are six of about 1,700 tons and 16·5 knots; four of about 1,350 tons and 16 knots; two are of 1,120 tons and 13·5 knots; one boat, the "Wacht," is of 1,250 tons and 19·6 knots; while the smallest gunboats are of about 900 tons, with speeds ranging from 12 to 21 knots according to the date of their launch. The vessels in this class are chiefly armed with the 4·1-inch and 3·4-inch rapid-fire guns.

Of the personnel of the German navy nothing is known beyond the fact that it is possessed of the physique and distinguished by the strict discipline which marks the fighting forces of Germany whether ashore or afloat. The German navy has seen next to no fighting in the half century of its existence; but, judging from the fighting record of the army, there is every reason to expect that the German sailors will, in conflict, do justice to the excellent fighting ships of which the modern navy is composed.

THE projected removal of the famous Ponte Vecchio of Florence has raised such a storm that its safety is doubtless insured for many years to come.

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SOME PACIFIC CEPHALOPODS.

BY PROF. C. F. HOLDER, PASADENA, CAL.

The deep channel of Santa Catalina, off the island of that name, is in the mythology of local fishermen the home of a school of gigantic fish which occasionally are seen disporting at the surface. These huge forms have not as yet been observed by scientific men, but that squids of large size abound, squids twelve or more feet in length, is well known. This was first made public by the presence of a school in the deep fjord-like harbor of Santa Catalina. There were but fifteen or twenty, but they came rushing into the quiet bay followed by a large school of jewfish, the latter weighing from one hundred and fifty to three hundred and fifty pounds. The squids soon ran into shallow water, where the Portuguese fishermen surrounded them with a seine. The squids ranged from ten to fifteen feet in length, and the entire catch, it was estimated, weighed eight or ten thousand pounds.

As they came in in the net they presented an extraordinary spectacle, spouting water and ink from their funnels, their broad bodies flushing and paling, changing color like chameleons, while the sucker-armed tentacles darted this way and that like so many fingers. The eyes were very large, jet black and staring. The amount of ink that can be thrown out by these animals was well illustrated here, as the water was blackened for yards about.

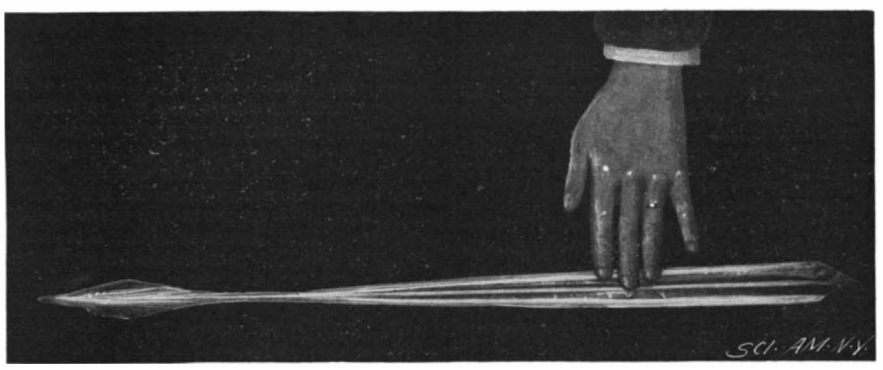
The writer recently observed the inshore rush of a school of squids on the southeast coast of the island mentioned. The animals weighed about thirty pounds each and were five or six feet in length. A school had undoubtedly been charged by some predaceous fishes, and in their efforts to escape they had been driven upon the rocks and so injured, either by contact or the attack of the fishes, that they were nearly all destroyed. The great bodies were strewn over the bottom for over one hundred square feet. But one squid was perfect, showing the two long tentacles and the eight short ones complete.

A dissection of the animal developed many of its interesting, indeed remarkable features. The so-called pen was nearly two feet in length in some instances, a beautiful object, an almost exact imitation of a pen. The ink bag was next examined, the delicate sac holding one or two tablespoonfuls of thick black ink, once the sepia of commerce. This remarkable pigment is the chief protection of the squid. When closely followed, the animal, by muscular effort, forces the ink into the siphon from which, mixed with the water, it is ejected, distributing itself in a cloud that easily confuses the follower and under cover of which the squid escapes. The force with which this ink can be ejected from the siphon can be judged from the fact that upon one occasion the writer's boatman when leaning over the water was struck full in the face at a distance of three feet by the stream. In experimenting with the octopus, it was found that when seized it immediately ejected its ink, but did not continue it when held. When thrown over it swam rapidly to the bottom, ejecting a stream of ink that formed a black spiral train like the smoke behind a mimic train of cars.

In the large squids which ran ashore an interesting feature was the fact that their food was found to be sea weed, small pieces of fulva ground up, nipped off by the beak. The latter was as large as that of a parrot, a remarkable organ, in color and shape calling to mind the beak of a parrot, though in the squid the lower bill projects above the upper.

In swimming the squids move tail first, impelled by the stream of water they force from their siphon. In this manner many dash into schools of fish with the velocity of light, the long arms seizing a fish, which is soon drawn against the parrot-like beak and the vertebra severed. The common squid of Santa Catalina is, so far as known, an algae eater. The octopus found here has a radial spread of fourteen feet and is a powerful creature, requiring the full strength of a strong man to dislodge.

One of the most interesting of the squids found at the island is the Cranchia. In specimens observed by the writer the body was large in proportion to the head, being four inches in length and three in diameter, and covered with minute tubercles or projections. The head was very small, and the tentacles short. It is rarely seen and must, being a slow swimmer, fall a victim to the predatory fishes which abound in these waters. Cranchia is a most interesting form on account of its phosphorescence, gleams of light playing over its body at night, making it one of the most interesting of the light-givers of the sea.



PEN OF SQUID NEARLY TWO FEET LONG.

TYPE OF SQUID TAKEN IN THE PACIFIC.

Patent Protection in Our New Colonies.

The following is published for the information and guidance of all concerned:

In territory subject to military government by the military forces of the United States, owners of patents, including design patents, which have been issued or which may hereafter be issued, and owners of trade marks, prints, and labels, duly registered in the United States Patent Office under the laws of the United States relating to the grant of patents and to the registration of trade marks, prints, and labels, shall receive the protection accorded them in the United States under said laws; and an infringement of the rights secured by lawful issue of a patent or by registration of a trade mark, print, or label, shall subject the person or party guilty of such infringement to the liabilities created and imposed by the laws of the United States relating to said matters:

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Acting Secretary of War.

War Department, Washington, April 11, 1899.

THE extremely great tenacity of life possessed by micro-organisms is demonstrated by the following experiments of the French savant M. Miquel:

He took from a public park a sample of earth, dried it for two days at a temperature of 30° C. and powdered it. The earth thus obtained he filled into sterilized glass vessels, which were sealed and kept in a place not reached by the light. The freshly dug out soil contained 6,500,000 bacteria per gramme which were reduced to 3,900,000 by the pulverizing and drying. After sixteen years the glass tubes were opened and there were still found to be 3,580,000 micro-organisms in a gramme of earth. Inoculated on a porpoise, they produced after two days the characteristic symptoms of tetanus attending wounds.—Technische Notizen.

Struggles of a Book Against Taxation.

In June, 1833, the late Charles Knight began the publication of the Penny Cyclopedia in numbers and monthly parts. At the time it was issued there was nothing of the kind in the English language, and the value and importance of the book was very great, and we must regard Charles Knight as the father of modern cheap literature, on account of this and other business ventures. The attitude of the British government at that time toward literature certainly did not tend to the multiplication of works. The Cyclopedia was begun in 1833 and was completed in 1846, and the result to the originator was a loss of $150,000, and this loss was practically caused by the excessive taxation of the British government, and the story of its publication is interesting now, as showing how printed matter was discriminated against in those days. The quantity of paper required to produce a single copy, which contained 15,764 pages, was two reams, which weighed 35 pounds. At the time of its commencement an excise duty of 6 cents per pound was collected on all paper. Of the entire edition, 20,000 reams paid this duty, which amounted to about $42,000, and the remaining 30,000 reams paid a reduced duty of 3 cents per pound, which amounted to $32,000, so that the total duty was not far from $75,000. In addition, a duty was charged on the millboards employed in binding the volumes and on the wrappers for the monthly parts, so that with interest and various losses caused by stocks on hand at the time the paper duty was reduced, the total amount of duty paid on the work was between $150,000 and $160,000, and the loss to the publisher was just about the same amount.

The Building Edition for April.

The SCIENTIFIC AMERICAN Building Edition for April is filled with interesting matter. A model cottage at Homewood, Long Island, is selected for the colored cover. The other illustrations show houses in various parts of the country and are fine examples of what architects are doing to-day for suburban residences. The "Castle of Vincigliata," near Florence, is illustrated and described. This castle has been most carefully restored to its pristine state and is one of the most remarkable fortresses of the feudal lord in existence. There are also several pages of most interesting reading matter.

The Current Supplement.

The current SUPPLEMENT, No. 1216, contains very important articles, notably "Acoma and the Enchanted Mesa," a most interesting article by Mr. G. Wharton James, illustrated by original photographs. "Trade Suggestions from United States Consuls" are twelve in number. The "Index to Consular Reports," a new feature, is also in evidence. "The Samoan Islands" are very much in the public eye at the present time, and the article on the subject is illustrated by eight engravings. "Porto Rico, the Land and the People," by Dr. William Hayes Ward, is also a most interesting and timely article. "Arithmetic Among the Ancient Egyptians," "Liquid Fuel," and "The Logical Arrangement of the Motive Power of Battleships," by Engineer-in-Chief George W. Melville, U. S. N., are important articles on the various subjects. The usual notes and selected formulæ are also given.

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RECENTLY PATENTED INVENTIONS.

Agricultural Implements.

MOWER-GUARD.—John C. Prout, Jr., Ogden, Utah. This invention provides a cap for mower-guards which can be used to restore a broken guard to its original shape, and which is so constructed that it can be sprung upon the guard and carried thereby without interfering with the action of the cutter-bar. The cap consists essentially of a body-portion conforming with the shape of the guard-finger, and a table projecting rearwardly from the body-portion. which is adapted to fill the position of a broken guard-section.

Mechanical Devices.

KNITTING-MACHINE. — George W. Ruth, Norristown, Penn. The inventor has devised a striping and splicing attachment for circular-ribbed-knitting machines, whereby an extra thickness of fabric is secured at any desired point, as, for example, half way around the knee of a stocking or around the heel. The attachment provided for this purpose breaks the splicing-yarn at the proper time, the break occurring near the hole through which the main yarn is fed, so that the end of the splicing-yarn may be readiiy taken up.

Railway-Appliances.

VALVE FOR AIR-BRAKE SYSTEMS.—William Palmer, Jr., Rincon, Territory of New Mexico. It is the purpose of this invention to provide means whereby the auxiliary reservoir can be recharged without the release of the brakes when descending heavy grades. These means consist of a retaining-valve, which coacts with the chamber of an air-holder, which automatically closes by reduction of pressure in the train-pipe, and which opens only when the pressure is restored to the same degree as in the chamber. By placing the engineer's brake-valve in release position and admitting the excess pressure to the train-pipe, the air-holder chamber will be charged to a higher pressure than that normally carried in the train-pipe when the brake-valve is in running position; and the auxiliary reservoir can be recharged without releasing the brakes, merely by placing the brake-valve in running position.

Miscellaneous Inventions.

STOCK-RACK FOR PLATFORM-SCALES.—Samuel J. Rice, Scotch Grove, Iowa. The platform-scales are provided with a stock-rack, the sides of which are adapted to be connected by a cross-bar hinged to one side and hooked to the other. On the sides of the rack, end gates are hung adapted to swing inwardly and fold on the corresponding side. Each of the posts of the rack is pivoted at its lower end so as to permit the sides to be swung outwardly when especially large loads are to be weighed.

CARBON-BRUSH HOLDER.—Renwick E. Crockett, Michigan City, Ind. The object of the invention is to construct the carbon-brush holder so that the brush can be entirely removed for inspection or raised from the surface of the commutator without altering the tension upon the brush. Within the body of the holder, a brush-casing is arranged to slide. A tension device is connected with the brush-casing and acts in the direction in which the casing is adapted to slide. The tension device is mounted to hold the brush-casing elevated or away from the surface adapted for engagement with the brush.

FOLDING SUPPORT OR HOLDER FOR ARTISTS' TABLETS. — William C. Shimoneck, Washington, D. C. This device is adapted for use in the field or where a table or desk is not available. The body of the tablet-holder is composed of leather, canvas, or other pliable material, held stretched by means of a collapsible frame formed of light metal bars which are detachable from one another in such a manner that the body of the tablet may be left free to be folded or rolled into compact form so that, together with the detachable frame-portion, it may be packed in a case for convenience of handling or of transportation.

ELEVATOR-DREDGE.—William S. Russell, Toledo, Ohio. This invention is concerned chiefly with the upper tumbler and chain of buckets used to raise the material from below the dredge and discharge it into a hopper. The tumbler has flat polygonal faces, with flat projecting blocks on the faces, and curved seats at the angles between the faces. Detachable wearing-plates are provided, having flat faces fitting the flat faces of the tumbler-blocks, and curved overlapping ends fitting into and locking against the curved seats of the tumbler, and adapted to receive the recesses and hubs of the buckets and links.

THILL-COUPLING.—Edward F. Colvin, Milton, Penn. Secured to the thill-iron is a pivot-bolt having a polygonal head. A clip having jaws provided with internal sockets is adapted to receive the ends of the bolt. One of these sockets has a rearward extension to receive the bolt-head and prevent accidental detachment thereof. A spring is arranged in the rear of the sockets. A cam or curved projection on the thill-iron head works in contact with the spring when the thill-iron is elevated and is free from or out of contact therewith when the thill-iron is lowered.

FOCUSING ATTACHMENT FOR CAMERAS.—Laird H. Wallace, Ogden, Utah. It is the object of this invention to provide means whereby the devices used in focusing on the ground glass of a camera are rendered more compact. The inventor secures this compact arrangement by furnishing a lens in the sight-opening of the hood, through which the image is viewed by the photographer. This is advantageous because it permits the eye to be brought closer to the object, and so enables a hood of less length to be used than would otherwise be possible.

SIPHON-FILTER. — Joseph G. Sutton, Seneca, Mo. The filter consists of a filtering-block formed of porous material, preferably a natural stone, known as "Missouri tripoli." This block has intersecting passage-ways bored therein, the outer ends of the passage-ways being closed by a plug of cement, and the discharge-ends being all in communication with a specially-constructed outlet-tube tightly cemented into the block. When immersed the block becomes saturated with water by capillary absorption until the central chambers are filled. The siphon outlet-tube then causes a continuous filtration therethrough.

SCRAPER.—Charles M. McMullen, Rock Glen, N. Y. To provide a scraper for use on the heating-pipes of brine tanks for removing salt-scale, is the object of the present invention. The scraper comprises a movable carriage which supports standards having elongated slots. Scraper-saddles are provided, shaped to fit the external surface of the pipes; and rods are connected with the saddles and loosely engage the elongated slots in the standards, whereby, when the carriage is moved, the scraper-saddles are tipped to bring the forward edges of the saddles into contact with the external surface of the pipes.

CONDUIT-THREADER.—Fredrick A. Pooler, Los Angeles, Cal. This inventor has devised improved means for drawing wire rods, cables, and the like through a conduit. The invention embodies a novel form of creeper or threader-rod having gripper-devices for preventing back movement, and a pair of operating cords adapted, when alternately drawn backward, first to cause the crawler-block to travel toward the head of the threader-rod and then to pull the crawler-block into gripping-engagement with the conduit wall, and at the same time to shoot the threader-rod forward, such movement being continued step by step until the head of the rod projects beyond the forward end of the conduit-section with which access may be had.

THILL-COUPLING.—John C. Bowers, Brooklyn, New York city. An axle-clip having a bearing is included in the construction of this coupling, which clip holds a coupling pin. The eye of a thill-iron engages the coupling-pin, and from the ends of the coupling-pin links are hung. A spring is held by the clip and is capable of engaging the eye of the thill-iron to hold it in place. A bell crank lever is fulcrumed between the links and presses the spring to hold it in engagement with the eye of the thill-iron. While the device is in use the coupling-pin or bolt is securely locked in position, but can be readily locked or unlocked for removal when changing from a shaft to a pole.

SUSPENDER-END.—William Bloomberg, Manhattan, New York city. The suspender-end is composed of buttonhole-tabs connected by a neck. Two clasp-supporting straps are formed integrally with the tabs and neck. A clasp is secured to and unites the lower ends of the straps, the two clasp-supporting straps extending from the main part at points at each side of the center of the neck and at an angle thereto. The suspender-end is simple, strong, and durable in construction.

WAISTBAND FOR TROUSERS.—Max Wald, Manhattan, New York city. This waistband for boys' knee-breeches is formed of a single blank of cloth, folded to form a lining, the lower end of which continues to an upwardly-extending folded member, terminating in a downwardly-extending member, both members forming a fold for connecting the lower edge of the lining with the lower edge of the button-flap extending in front of the lining. Elastic pieces are stitched in alinement with some of the button-holes. When a strain is exerted on the button-flap, the elastic pieces take up the strain.

FILTER.—Edgar L. Stream, New Orleans, La. The filter comprises a tank, a tubular shaft mounted in the tank, and disks on the shaft. A face or periphery of perforated material is provided for the disks, and an endless apron of filter material has its edges engaging the disks. A rotary brush engages the apron within the tank. When the filtering material becomes clogged, the liquid in the tank will rise to the level of the brush; the liquid will filter through the apron and run out through the tubular shaft. The brush will clean the apron of sediment before it passes into the liquid to be filtered.

TORCH-BURNER.—William A. Nicholas and Gustave Burkhardt, Chicago, Ill. The torch-burner of these inventors is of the type used for brazing bicycle-frames, and is designed to be used by jewelers and electricians as well as bicycle-manufacturers. In a casing open at both ends, an open-ended perforated nozzle is centrally situated. A perforated flange rigidly supports and centers the nozzle. A tubular interrupter or spreader is arranged in front of and in alinement with the nozzle and serves to break up the two divided currents which emerge from the perforations of the nozzle and from the nozzle itself.

DOOR-CHECK. —John Speirs, Jersey City, N. J. The invention seeks to provide a lock for a door, so constructed that the door may be held partially open for the purpose of ventilation or for the purpose of enabling one to see a person who is demanding entrance. The lock is operated entirely from within, and when set merely to provide ventilation, it will not be possible to force the door sufficiently to effect an entrance, or to tamper with the lock from the outside.

ACETYLENE GAS GENERATOR.—James W. Kinry, Beloit, Kans. This apparatus comprises a generator, a cooling-chamber, and a gasometer. The gas formed in the generator passes into the cooling-chamber, and then into the gasometer. A water supply pipe connects the cooling-chamber with the generator, and is provided with a valve controlled by the rise and fall of the gasometer, so as to regulate the supply of gas automatically.

Designs.

GAME-BOARD.—Paul R. G. Sjöström, Westfield, N. J. The leading feature of this design consists of a base, upon which is a rectangle formed in double lines terminating in disks at the corners, and also having disks intermediate of the corners. Within the rectangle mentioned, other rectangles are variously disposed, in the lines of which, disks are arranged. Outside of the rectangles are other figures also terminating in disks. The game constitutes a kind of maze puzzle and is played by means of checkers.

TRACE-CARRIER.—Frank G. Engberg, Kindred, N. D. The carrier consists of an elongated loop having at one end a neck which is forked and return-bent, so as to form double hooks.

PIPE-COUPLING.—Jere J. Hanrahan, Brooklyn, New York city. The coupling-section is screw-threaded at both ends. At right angles to the body of the section, a cylindrical portion is secured, which is provided with a projecting perforated ear. The coupling is more compact than that ordinarily employed and consequently presents a neater appearance.

MONUMENT.—Edwin O. Townsend, Manhattan, New York city. The monument provided by this design consists of a massive base upon which there stands a polished block of stone ornamented by moldings and carvings.

CARPET.—Eugene A. Crowe, Brooklyn, New York city. Upon the carpet there is represented a shield emblazoned with an ax and a mallet, the handles of which are crossed. Foliate sprays, a horn of plenty, a pair of scales, and a vase complete the design.

NOTE.—Copies of any of these patents will be furnished by Munn & Co. for ten cents each. Please send the name of the patentee, title of the invention, and date of this paper.

NEW BOOKS, ETC.

How to Gain Admission to Annapolis, West Point, or the Schoolship St. Mary's. New York: S. A. Nelson, 16 Park Place. 1898. Price 50 and 75 cents.

We have often been asked questions as to how admission may be gained to the army and navy or to the professional schools which turn out officers for the two services. The little volume before us is adapted to give precisely information of this class, and, so far as we know, the field which it covers is a new one. Of course, a candidate for admission to either school can obtain information by addressing the War and Navy Departments, but there are many things which a candidate would like to know in relation to them which cannot be readily obtained, and this volume is intended to give exactly this information. There is also a list of the leading military schools and colleges in the United States.

Text-Book of Physics. Sound. By J. H. Poynting and J. J. Thomson. London: Charles Griffin & Company. Philadelphia: J. B. Lippincott Company. 1899. 8vo. Pp. 163. 85 figures. Price $3.

The present volume deals entirely with sound. The text-book is intended chiefly for the use of the students who lay most stress on the study of the experimental part of physics and who have not reached the stage at which the reading of advanced treatises on various subjects is desirable. It will serve admirably as an introduction to Helmholtz's great work entitled "The Sensation of Tone," which deals chiefly with the physiological aspect of sound, and to Lord Rayleigh's "Theory of Sound," at once the most systematic, original, and complete work on the subject. The present volume is none too free from mathematics, but at the same time can undoubtedly be mastered even by those who have little mathematical training. The authors are both well-known physicists, and anything which emanates from their pens is sure to be of value.

English Cathedrals. By Francis Bond. London: George Newnes, Limited. Philadelphia: J. B. Lippincott Company. 1899. 16mo. Pp. 314. Price $2.

There are already a number of excellent books upon cathedrals, including Mrs. Van Rensselaer's and Bell's Cathedral Series, to say nothing of the older works. There are also several volumes which bear the name of great church dignitaries, which might just as well not have been written, as they are confused and abound with errors and solecisms. The present volume is of an entirely different nature, and will be warmly welcomed by the student of cathedrals, notwithstanding the fact that the literature on the subject is already large. The volnme takes up the architectural aspect particularly by what might be termed the "biographical" method, and this is what is so much needed by so many students. The text is most valuable. It is clear and scholarly, and the illustrations, while reproduced on a very small scale, still serve to elucidate the text. The book would be of great value if taken with the tourist into the cathedral towns. The author will not spare the visitor's legs, but no one can see a cathedral without considerable marching and countermarching.

The Shipping World Year Book. A Desk Manual of Trade, Commerce, and Navigation. Edited by Evan Rowland Jones. London: Shipping World Office. 1899. 16mo. Pp. 1140. Price $2.

The annual year book published by The Shipping World is one of great importance to all who are in any way interested either in ocean transportation or in dispatching goods of any kind. It is filled with valuable information, such as the tariffs of all countries, a port directory giving particulars of all British and foreign ports, the rates for pilotage and towage, the dimensions of harbors, dry docks, etc. There are also many tables of distances, etc., which are very important for seamen. There is no question that this little book is at the head of its class.

Commercial Management of English Works. By Francis G. Burton. Manchester, England: The Mechanical Engineer. 1899. Pp. 310. 8vo. Price $5.

The volume before us goes into the organization of commercial establishments, such as engineering works. It defines the duties of the various offices, and shows how they should be performed in an economical manner. Various methods of keeping books, stock, drawings, etc., are also entered into. There is little question that many large concerns could adopt the methods advocated by Mr. Burton with good results. Of course, the present volume is specially intended for use in Great Britain, but at the same time the methods given would prove of value in this country.

How to Prepare for a Civil Service Examination. With Recent Questions and Answers. By Francis E. Leupp. New York: Hynes & Noble. 1899. 12mo. Pp. 547. Price $2.

The government of the United States is a good employer to those who do not possess the inclination or means for entering into professional life or into independent money-making adventures. Civil Service has been used by many young men and women as a path to a larger field of effort in private life. To those who wish to fit themselves for civil service examinations many problems are presented, and it is to aid in solving these problems that the present volume has been prepared. The examinations are eminently of a practical character, and much time and energy may be saved by a perusal of the book before us, as any candidate may learn from it just what is necessary and what is unnecessary in brushing up his studies. Advice is given as to the chances of making one's way into the civil service and of staying there. The book is admirably arranged, and cannot but prove of the greatest possible value to every candidate.

Chemical and Metallurgical Handbook for the Use of Chemists, Metallurgists, and Mining Engineers. Second Edition. By J. H. Cremer and G. A. Bicknell. Cleveland, O.: Published by the Author. Pocket book form, leather, gilt. Pp. 337. Price $3.

Chemical literature is probably the most extensive of any science, with the exception of possibly electricity, yet the number of practical works is astonishingly small, and for this reason we welcome works like the present, which give chemists and those in need of chemical information exactly what is needed without going into theory. After atomic weights the reactions of metallic salts are given in a particularly concise form; then come tables showing the molecular weight, specific gravity, melting point, boiling point, and solubility of the principal inorganic compounds. Then come the laws of chemistry, percentages of alcohol, specific gravity of sulphuric, nitric and hydrochloric acids. Then follow methods for the analysis of iron ore, pig iron, steel, coal, coke, etc. This is followed by various tables which are specially useful to the metallurgist.

Salva-Webster. An English-Spanish and Spanish-English Dictionary. Compiled by J. Gomez, Ph.D. Edited by F. M. de Rivas. Chicago: Laird & Lee. 1899. Pp. 382. 24mo. Double Index. Price 40 and 75 cents and $1.

A small Spanish dictionary handy for the desk was never more acceptable than at the present time, now that we have extensive colonies where Spanish is spoken. The dictionary itself is a model one for its size, and it is one of the modern wonders of book-making that a double-indexed dictionary, of this size, substantially bound, can be sold for such a small sum. It is admirably adapted for the use of those who occasionally receive Spanish commercial letters.

With Sampson Through the War. By W. A. M. Goode. With Contributed Chapters by Rear-Admiral Sampson, U. S. N., Captain R. D. Evans, U. S. N., Commodore C. C. Todd, U. S. N. New York: Doubleday & McClure Company. 1899. Pp. 307. Illustrated. Price $2.50.

The volume before us is an important contribution to the literature of the Spanish-American war, a literature which is already appalling in size. The book is an account of the naval operations of the North Atlantic squadron during the Spanish-American war of 1898, and was written by a correspondent of the Associated Press. The book may fairly be said to be the authoritative work of the North Atlantic squadron during the Spanish-American war, and it contains a true history of the famous Santiago fight, besides clearing up many mooted points. It is admirably written and is well calculated to give an excellent idea of the causes which led up to war and the war itself.

Roentgen Rays. Memoirs. By Roentgen, G. G. Stokes and J. J. Thomson. Translated and edited by George H. Barker. New York: Harper Brothers. 1899. Pp. 76. 12mo.

The volume before us is one of the series which the publishers are issuing, entitled Harpers' Scientific Memoirs. We have already reviewed two previous volumes which presented classic papers; we now come to equally important papers which are of comparatively recent date. The original communication of Prof. Roentgen will probably always be one of the great classics of physics, and it is gratifying to have the papers admirably translated by a physicist of repute and published in a worthy form. In addition there is Sir G. G. Stokes' "On the Nature of Roentgen Rays" and Prof. J. J. Thomson's "A Theory of the Connection Between Cathode and Roentgen Rays."

Michael Faraday: His Life and Work. By Silvanus P. Thompson, D.Sc., F.R.S. New York: The Macmillan Company. 1898. Pp. 308. 12mo. Price $1.25.

The Faraday literature is much larger than might be supposed. It is seldom that a man of science is honored by such biographies as have been penned by Dr. Bence Jones, Prof. Tyndall, Prof. Clerk Maxwell and Dr. Gladstone. Faraday is, however, worth it all, and when the final summing up of the scientific history of the century shall be made, Michael Faraday will be in the front rank among the little band of men whose pre-eminent achievements extended the boundaries of knowledge. Faraday is the beau ideal of the man of science, and for forty years his was the living and inspiring voice at the Royal Institution, and while there his researches in physics laid the foundations of electrical engineering. So much for the man and his relation to his time. At the present day probably no one is better qualified to take up the rather difficult task than Prof. Thompson, himself a brilliant physicist, and he has acquitted himself admirably; in fact, his lucid style is well adapted to portray the great discoverer and reveal him in his true light. We cannot undertake to give even a synopsis of the chapters, but recommend any one interested either in science, electricity, or even biography itself to purchase this book, whose cost is not forbidding. The excellent frontispiece portrait is marked with the initials S. P. T. If Prof. Thompson really drew the portrait, he deserves additional thanks.

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THE MODERN THEORY OF SOLUTION. A Memoir by Pfeffer, Van't Hoff, Arrhenius and Raoul. Translated and edited by H. C Jones, Ph.D. New York: Harper Brothers. 1899. Pp. 133 12mo.

The book before us will prove of great value to all those who are interested in theoretical chemistry, and the papers which are included in it are of great importance and the bibliography is very complete. This is also a volume of Harpers' Scientific Memoirs, and we are glad to note that six other volumes of the series are now in active preparation.

TWENTIETH CENTURY SKETCH BOOK. By M. H. Avery, Woonsocket R. I. 1898. Price 50 cents.

This up-to-date method of sketching will doubtless prove interesting to many who are anxious to make progress in mechanical and geometrical and trigonometrical drawing. No drawing-board, T-square, scale, angles, or protractor are required. It is made in two parts, one without angle readings and the other with angle readings.

THE BRITISH NAVY. By A. Stenzel, Captain Imperial German Navy, Retired. New York: E. P. Dutton & Company. London: T. Fisher Unwin. 1898. Pp. 327. 4to. Price $5.

This work, a translation from the German, has a special interest due to the fact that it is an impartial survey of the British navy from the standpoint of a trained foreign critic. While the general tone of the book is distinctly complimentary, Captain Stenzel is at times severely critical, and indicates what seem to be the weak points both in the material and administration of the British navy. The work opens with a historic survey, followed by chapters on the Admiralty and its naval policy. Then follow a comprehensive description of the stations and dockyards, and chapters on the personnel, the education and training, and the uniform of the navy. This matter will be much of it new to the general reader, and not so familiar as that contained in the chapter on material. This last, although it goes over well-worked ground, is excellent in its arrangement and selection. It commences with the historical development, showing excellent photographic views of the last and largest of the old 3-deckers, as represented by the "Duke of Wellington," of 131 guns and 6,071 tons. The growth of the armorclad ship is traced by diagram, photograph, and description from the "Wellington" to the modern "Majestic." The illustrations are many and excellent, and the work is concluded with a complete table showing all the ships of the navy, with their particulars of size, speed, armament, and cruising qualities.

HANDBUCH DER TELEPHONIE. Nach dem Manuscript des Dr. Victor Wietlisbach. Bearbeitet von Dr. Robert Weber. Vienna: A. Hartleben. 1899. 372 illustrations. Large 8vo. Pp. xiv., 368. Price $3.

The work of the late Dr. Wietlisbach, which lies before us, constitutes one of the most valuable contributions to the literature of telephony which has yet appeared. The eminent position occupied by the author as Weiland director of the Swiss telephone service in Bern, and his vast technical knowledge, well fitted him for the task of producing a handbook which has surpassed anything that has yet appeared in German The care bestowed upon every detail of the subject, the clearness of the verbal and mathematical explanations, and the exhaustiveness with which everything relating to the telephone has been discussed, should earn for the book a prominent place in the technical library of every electrician.

PAGANINI'S PHOTOGRAMMETRISCHE INSTRUMENTE UND APPARATE FUR DIE REKONSTRUKTION PHOTOGRAMMETRISCHER AUFNAHMEN. Von Prof. E. Dolezal. Separat-Abdruck aus Der Mechaniker. Berlin W.: F. and M. Harrwitz. 1899. 9 illustrations. Price 50 cents.

In 1855, Prof. Porro, of Milan, made the first attempt at applying the camera to geodesy, and thus founded the modern science of photogrammetry. Since Porro's time savants have endeavored to develop the results obtained and to bring this new branch of surveying into more general use. Of these men perhaps the most prominent is Prof. L. P. Paganini, Director of the Photographic Division of the Military Geographical Institute of Florence. The little pamphlet which lies before us is a reprint of an article which appeared in Der Mechaniker, and gives a history of Paganini's work and describes in detail the various instruments which he has invented. Since Paganini is so closely identified with the development of photogrammetry, it necessarily follows that Prof. Dolezal's article contains everything that is now known of the science. His pamphlet is therefore to be considered as a valuable contribution to the literature of geodesy.

ORGANIC CHEMISTRY OF CARBON COMPOUNDS. By Victor von Richter. Edited by Prof. R. Anschütz. Translated by Prof. Edgar F. Smith. Vol. I. Chemistry of Aliphatic Series. Philadelphia: P. Blakiston's Son & Company. 1899. 8vo. Pp. 635. Price $3.

Richter's Organic Chemistry is well known in the United States as a standard work, which no chemical library can do without. The present work is a translation from the eighth German edition, which has been ably edited by Prof. Anschütz, and the subject matter is vastly different from that given in the earlier editions. The marvelous advances in the various lines of synthetic organic chemistry have made many of the changes in the text absolutely necessary. It is a book which can be confidently recommended to all who are in need of an advanced work on organic chemistry. The second volume, which will be devoted to "The Aromatic Series," is in rapid preparation, and will be published during 1899.

Business and Personal.

The charge for insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in the following week's issue.

Marine Iron Works. Chicago. Catalogue free.

For mining engines. J. S. Mundy, Newark. N. J

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Roche's "New Standard" Electric Necktie Pin. Works like a charm. Midget Battery. The electric light is a beauty and a wonder. Sent postpaid for $1.00. Agents wanted. Wm. Roche, 259 Greenwich St., New York.

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Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters or no attention will be paid thereto. This is for our information and not for publication.
References to former articles or answers should give date of paper and page or number of question.
Inquiries not answered in reasonable time should be repeated: correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.
Buyers wishing to purchase any article not advertised in our columns will be furnished with addresses of houses manufacturing or carrying the same.
Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.
Scientific American Supplements referred to may be had at the office. Price 10 cents each.
Books referred to promptly supplied on receipt of price.
Minerals sent for examination should be distinctly marked or labeled.

(7642) J. A. K. asks for a formula for making blue prints of maps, etc. I used red prussiate potas., 120 gr.; ammonia cit. and iron, 140 gr.; pure water, 4 oz.; mixed them separately, and then poured together, but the white was of a yellowish cast instead of a white. A. We think the proportion of chemicals is too small. Try using the following: Iron and ammonium citrate saturated, 1 oz.; water, 4 oz. Mix up this solution separately and then mix another solution composed of potassium ferrocyanide and water, 4 oz. For use mix equal quantities and float the paper for two minutes.

(7643) H. A. S. asks: 1. Will an electric current meter which is made for 104 volts register the proper amount if used when the voltage is 115? A. A current meter is not made for the voltage, but for the amperes which pass through it. It will register more current if lamps which are made for 104 volts are put upon a 115 volt current, since more current will then flow. This is because the filament becomes hotter and its resistance is made lower. 2. Please inform me also how to remove grease or oil from an old belt so the cement will hold in splicing. A. Soak the ends of the belt in benzine and the oil will be dissolved.

(7644) R. C. asks: Can liquid oxygen be kept securely in any suitable receiving vessel? Is it as yet a commercial commodity? A. Any substance with a boiling point below the ordinary temperature of the air cannot remain in the liquid form in the open air. It will boil and pass into the form of vapor. This is the reason why liquid oxygen or liquid air cannot be kept in the liquid form. It boils at about 300° Fah. below zero. It absorbs heat rapidly from the air because of the great difference between it and ordinary air in temperature, and boils away very rapidly. If held in a receptacle till it had reached the temperature of the air, the pressure would be 10,000 to 12,000 pounds per square inch. This is the same as saying that it is impossible to confine it. It is not on sale anywhere.

(7645) H. G. W. writes: Will you please tell me what baths are used to cleanse brass to prepare it for polishing? I refer to old brass which is to be refinished. Also is there any way to restore the finish of hard rubber which has grown green and dead looking? A. Try removing the lacquer with alcohol; after this is done, you can proceed to clean the brass. There are many substances and mixtures which will clean brass, as oxalic acid, hydrochloric acid, and there are other acids which will do it, but probably oxalic acid is the best. The acid must be well washed off and the brass dried. It should be remembered that oxalic acid is poisonous. You will find it almost impossible to restore the color to hard rubber. We recommend you to try polishing it with very fine putty powder and water and finish with a piece of silk.

(7646) C. M. writes: A friend of mine has a lightning rod on his house fastened close to the wall (frame house) by strips of sheet iron, instead of leaving a space of some inches. The end of the rod is about 2 feet in the ground, having no plate on its end, and I often read in books that all the water and gas pipes must be connected to the rod. Please let me know if this is right or not. Can I test the lightning rod with a magneto machine, and how can I do it? Can you refer me to any SUPPLEMENT describing how a lightning rod must be erected? A. Putting a lightning rod on a house is a very simple matter. Fasten it as firmly to the house as possible. An air gap is of no consequence. Do not insulate the rod from the house. Connect the water pipes to the rod. If there are no water pipes, ground the rod in a moist place with an ample iron plate. Carry the rod above the house at least 4 feet, at all gables and chimneys. Tip each upper end with several points. Iron rods are as good as or better than copper. To test the joints with a magneto, bring wires from the top and the bottom of the rod to the magneto and see if the bell rings well through the rod as a part of the circuit. To test the ground with a magneto, connect the rod and the magneto by one wire. Run another wire from the other side of the magneto to a ground near the ground plate of the rod. The best article that has appeared in many years upon lightning rods is by Mr. McAdie, of the United States Weather Bureau, in SUPPLEMENT, No. 998, price 10 cents. The subject is well treated in Thompson's "Elementary Lessons in Electricity," price $1.40 by mail.

(7647) A. J. A. writes: Some time ago you gave a formula for cleaning and polishing sea shells. I cannot find the article treating upon this subject. Have looked papers through with aid of index several times. A. 1. Porcelainous shells are so hard as to require the apparatus of a lapidary to cut or polish them, but they are generally so smooth as to require no rough grinding. They may be polished by using a felt wheel and applying putty powder. Nacreous shells or those of the pearl variety may be filed and cut without a great deal of difficulty. Pieces to be turned are first roughly shaped on the grindstone, then turned and polished with pumice stone, putting on the final polish with rottenstone. Irregularly shaped pieces are filed and ground, then smoothed with pumice stone and water, and finished with rottenstone. The rottenstone is sometimes mixed with sulphuric acid full strength, or slightly diluted, to heighten the polish. 2. Rough shells are polished by first grinding them on a coarse stone, then smoothing them with pumice stone and water on a buffer wheel or with a hand polisher, and finishing with rottenstone.

(7648) F. E. L. asks: Does the chain on a bicycle travel faster or slower according to the size of the sprocket wheels, the gear remaining the same, and if so, is the work that it performs heavy or light in the same proportion to the speed that it travels? A. The chain on the larger sprockets travels the fastest for a given gear and has the lightest work.

TO INVENTORS

An experience of fifty years, and the preparation of more than one hundred thousand applications for patents at home and abroad, enable us to understand the laws and practice on both continents, and to possess unequaled facilities for procuring patents everywhere A synopsis of the patent laws of the United States and all foreign countries may be had on application, and persons contemplating the securing of patents, either at home or abroad, are invited to write to this office for prices, which are low, in accordance with the times and our extensive facilities for conducting the business, Address MUNN & CO., office SCIENTIFIC AMERICAN, 361 Broadway, New York.

INDEX OF INVENTIONS

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APRIL 11, 1899.

AND EACH BEARING THAT DATE.

[See note at end of list about copies of these patents.]

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Air brake, C. F. Bane ... 622,750
Air heating and agitating apparatus, E. F. Porter ... 622,863
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Automatic register, K. D. Camp ... 622,756
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Boiler cleaner, J. C. Frideritzi ... 622,920
Boiler tube cutter and expander, W. D. Hervey ... 622,681
Bolt and lock, combined, J. M. Forney ... 622,676
Bolt socket, king, H. C. Swan ... 622,904
Book leaf, W. A. Vawter ... 622,986
Boot or shoe tree, O. I. Howe ... 623,085
Bottle, B. Ver Standig ... 622,737
Bottle, non-refillable, J. Evinof ... 622,887
Bottle, non-refillable, T. P. Greenhow ... 623,010
Bottle, non-refillable, A. G. Snowdon ... 623,047
Bottle stopper, W. P. Bonwick ... 623,070
Bottle washer, Cobb & Dyer ... 622,883
Bottle wrapper, J. C. Scheuffler ... 622,715
Bowling alley, P. C. Biersach ... 622,660
Box. See Cigar box. Display box. Feed box. File box.
Bracket. See Shelf bracket.
Brake. See Air brake. Car brake.
Brake beam, W. A. Pungs ... 622,781
Bridge, draw, F. Hoch ... 622,685
Brush machine, M. Heliwig ... 622,768
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Buckets, means for tripping, L. A. Cook ... 622,840
Bulkhead doors, means for automatically closing, A. von Knorring ... 622,956
Burglar alarm, H. A. Holloman ... 623,019
Burglar alarm and lamplighter, combined, J. J. Hinson ... 622,684
Burner. See Gas burner. Vapor burner.
Butter holding and slicing apparatus, G. B. Lehy ... 622,898
Butter package, J. W. Barnes ... 623,116
Button, C. J. Higley ... 622,683
Cable support, W. A. Nordyke ... 622,778
Camera, folding photographic, Hill & Price ... 622,853
Camera, photographic magazine, A. Lechi ... 622,959
Can jacket, F. E. Jordan ... 622,806
Car air pipe coupling, railway, M. F. Sinclair ... 622,980
Car brake, G. Lewis ... 622,697
Car brake, street, J. G. Schumann ... 622,930
Car coupling, G. Findlay ... 622,674
Car coupling, C. A. Taylor ... 622,786
Car coupling, T. Whaley ... 622,874
Car, dumping, N. Barney ... 622,909
Car gate, E. P. Sargent ... 623,039
Car sill or stringer, R. W. Oswald ... 622,971
Car, street railway, E. G. Allen ... 622,656
Carbon sorting machine, Richmond & Zellers ... 623,036
Carbureter, C. M. Kemp ... 622,808
Card and envelop, quotation, J. E. Hewett ... 622,852
Card holder and ejector, R. Joy ... 622,807
Carding engine, Mills & Penney ... 623,094
Carding engines, apparatus for grinding flats for rotary, C. Mills ... 623,095
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Cartridge loading machine, F. Render ... 622,711
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Churn, N. Decker ... 623,076
Churn, O. F. Vaughan ... 622,985
Churn, T. W. Wood ... 623,059
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Cigar box, W. Tribble ... 622,932
Circuit breaker, H. E. Andersson ... 622,657
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Coating one metal with another, etc., S. H. Thurston ... 622,732
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Cornet, J. J. Neumann ... 622,820
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Cultivator, I. Detheridge ... 622,996
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Dental chair, A. J. May ... 623,026
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Dish washer, E. W. Sullivan ... 622,730
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Displaying device, A. C. Mills, Jr ... 623,027
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Electric light radiator, H. Stenz ... 622,785
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Nozzle and sprayer, combined, G. F. Wentz	623,057
Nut, axle, S. M. Ford	622,764
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Pencil sharpener, H. Buchanan	622,892
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Pipe fitting, wrought metal, J. J. Lawler	622,897
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Potato digger and sorter, A. S. McDonald	622,970
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Railway switch, street, C. Stadtfeld	622,724
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Resistance device, F. L. Ellingwood	623,079
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Road breaking machinery, H. H. Hosack	622,804
Rolling flanged bars, A. Morrison	622,967
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Rolling gate, E. E. Gustin	622,890
Rolling mill, E. W. G. C. Hoffmann	622,801
Rotary engine, G. W. Hunter	622,952
Rotary engine, McPherson & Laing	622,704
Rotary engine, E. Seymour	622,718
Routing machine, F. Wesel	622,832
Rubber or other endless bands or strips, manufacturing India, J. M. MacLulich	622,774
Rubber tired wheel, T. J. Reid	623,034
Sad iron holder, Weiss & Frauenhar	623,055
Safe, screw door, C. E. Blechschmidt	622,753
Safety appliance, F. L. Ellingwood	623,078
Safety appliance and device for operating same, F. L. Ellingwood	623,080
Sash fastener, T. B. Stevens	622,903
Sash holder, W. H. Stevens	622,828
Sash, window, J. A. Golden	623,005
Saw, circular shingle, S. T. Johnson	622,954
Saw, drag, L. Phillipps	622,709
Sawmill steam set works, Corry & Barker (reissue)	11,732
Saw sharpening machine, L. L. Filstrup (reissue)	11,733
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Shade support, J. Benzion	622,837
Shade trimmer, D. H. James	623,021
Shafts, means for detachably securing hubs of crank arms or like parts to, J. H. Holck	622,686
Shawl strap or bundle carrier, R. J. Lay	622,958
Shelf bracket, J. E. Twitchell	622,933
Shell for high explosives, C. N. Chambers	622,994
Ships' cables, apparatus for cleaning, B. M. Whitlock	622,833
Shoe or glove and fastener for same, Finsrud & Ramberg	622,675
Shoe polisher, R. D. Voorhees	623,051
Shoulder pad, G. Goldman	622,765
Sign, electrically illuminated, W. T. Bell	622,910
Skate, T. W. Bryant	622,838
Skate fastening, E. H. Barney	622,908
Skate, road, A. N. Lindsley	622,815
Skin or fabric, flexible, J. H. Stevens	622,727
Skirt supporter, J. H. & I. Taylor	622,731
Slate cleaner, J. H. Wellborn	623,056
Sleeping bag, A. Lapierre	622,812
Sleeve holder, coat, H. Williams	623,058
Sliver can marker, E. W. Houghton	623,083
Snap hook, R. W. Jones	622,770
Soap holder, J. H. Welch	622,873
Sole, A. Sessler	622,825
Spark arrester, N. P. Stevens	622,829
Spinning machine, E. K. Baker	622,836
Spout, flexible, W. A. Nutt	622,706
Spraying machine, M. B. Brooks	622,664
Sprocket driving wheel, Voce & Drysdale	622,738
Stamp battery ore feeder, Dobson & Alexander	622,763
Stamp, marking, T. H. Sorlien	623,048
Steam engine, Dishner & Lindsey	622,762
Steam separator, R. C. Carpenter	622,757
Steam trap, F. Knackstedt	622,925
Steel from vessels or furnaces to moulds, means for transferring, A. D. Burt	623,073
Steering mechanism, electrical, A. L. Riker	622,977
Sterilizing milk, method of and apparatus for, N. Bendixen	622,659
Stool, automatic, Greb & Heid	623,008
Stopper. See Bottle stopper.	
Stove, H. H. Herrendeen	622,951
Stove cover and gas burner, combined, A. Griffith	622,894
Stove, heating, H. C. Baker	623,115
Stove or furnace, A. M. Blakesley	622,752
Strainer, milk, H. Fitchie	622,919
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Swimming apparatus, G. Zacker	623,060
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Switching apparatus and method of counteracting arcs, J. Cloos	623,120
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Telescopic clamp, G. W. Kortright (reissue)	11,731
Temperature indicator, electric, J. H. Dorion	622,917
Tenoning machine, W. Brodhage	622,794
Thill coupling, J. Mealey	623,091
Thill support, R. T. Gillespie	623,004
Tie plate, A. Morrison	622,965
Time recorder, S. A. Dean	622,795
Time wheel mechanism, G. Smethurst	622,869
Tire, car wheel, C. H. F. Huser	622,692
Tire, pneumatic, W. L. Dreisbach	622,796
Tire, wheel, Huntsberry & Laveen	622,923
Tires, means for joining ends of inner tubes of pneumatic, F. R. Chamberlain	623,074
Tires, valve for endless tubing for, J. B. Forsyth	622,888
Tobacco cutter, J. Van der Plaat	622,905
Tobacco stemming machine, R. A. Coffee	622,995
Tobacco treating machine, J. K. Proctor	622,976
Tool, J. S. Scott	623,041
Tooth crown, W. H. Dwight	622,670
Toy or game, T. Brighton	622,663
Traction engine, A. Stutzman	622,729
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Trolley, R. E. Carroll	622,991
Trolley, S. T. Leaming, Jr	622,813
Trolley or other wires, splicer for, M. M. Wood	622,747
Trough. See Eaves trough.	
Trunk, P. H. Smith	622,870
Trunk, H. M. Turner	622,734
Trunk strap, B. F. Mellott	622,776
Tubular fabric, machine for turning and cutting, F. A. Weller	622,741
Tufted fabrics, machine for making, C. S. E. Spoerl	622,901
Typewriter attachment, D. K. Wenrich	622,789
Unchecking device, J. P. Hart	622,767

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Advertisements.

ORDINARY RATES.

Inside Page, each insertion, - 75 cents a line
Back Page, each insertion, - - $1.00 a line

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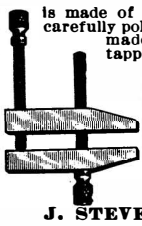
The above are charges per agate line—about eight words per line. This notice shows the width of the line, and is set in agate type. Engravings may head advertisements at the same rate per agate line, by measurement, as the letter press. Advertisements must be received at Publication Office as early as Thursday morning to appear in the following week's issue.

Our Toolmakers' Clamp



is made of highest quality steel, case hardened, carefully polished and finished. The best clamp made for holding small work in drilling, tapping, etc.

Made in following sizes:

1½ inch, price, postpaid, each 50 cents.
2⅛ " " " " 65 "
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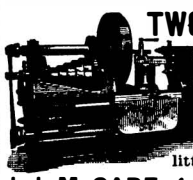

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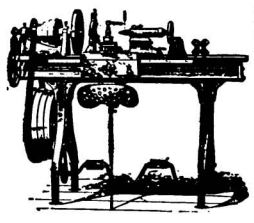

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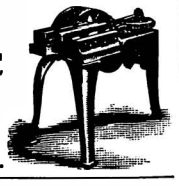

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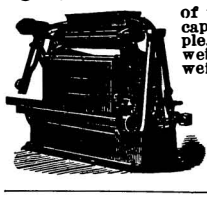

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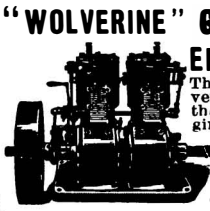

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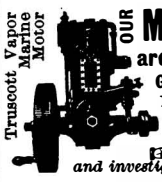

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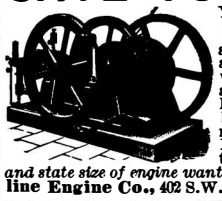

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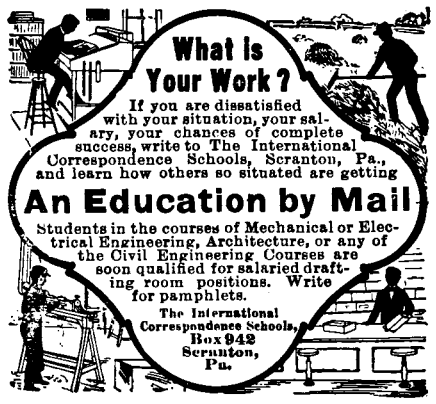

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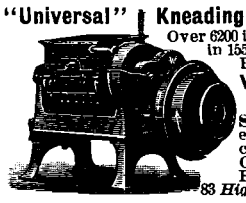
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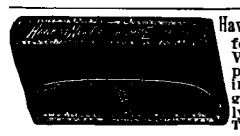
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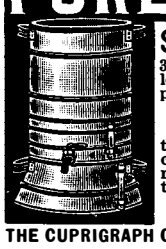
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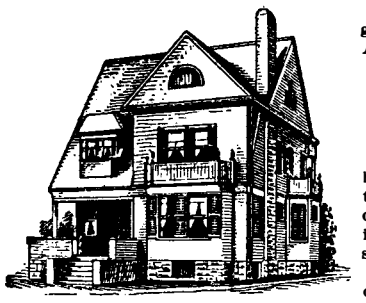
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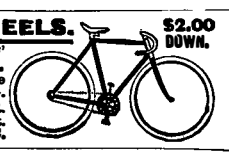
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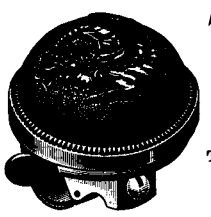

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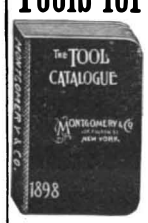

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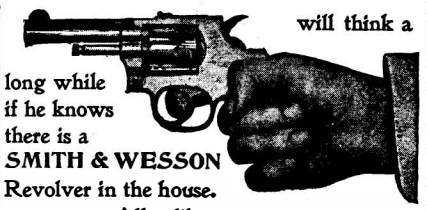

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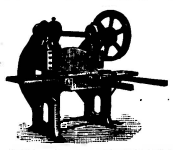

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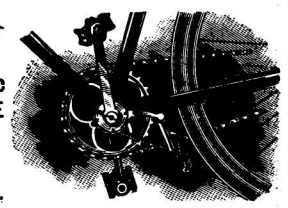

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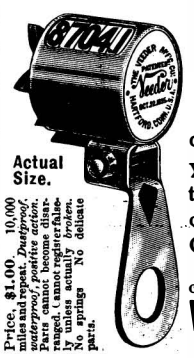

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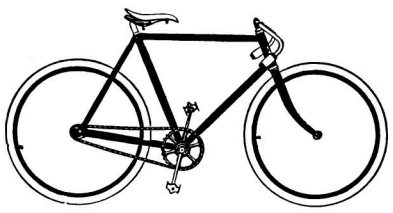

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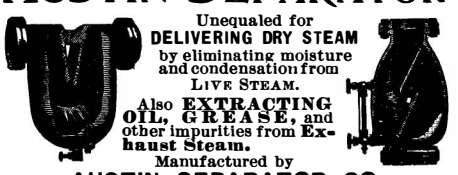

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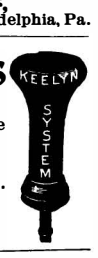

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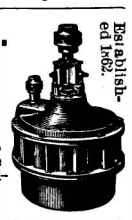

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